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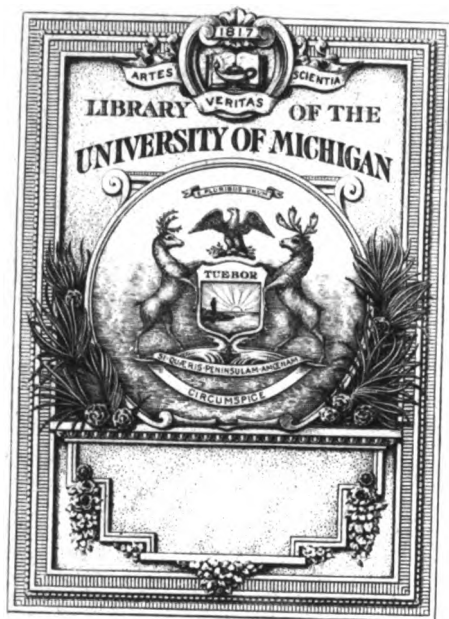
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TRANSACTIONS OF THE

SECTION ON

**Laryngology, Otology
and Rhinology**



of the
American Medical Association
at the Sixty-Seventh Annual
Session, held at Detroit,
Michigan, June 13 to 16, 1916

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LIST OF OFFICERS

This Section was organized in 1888 (by dividing the previously existing Section on Ophthalmology, Otology and Laryngology) and has been served by the officers named below. This list has been compiled from the published records of the Association. It is possible that some errors have been made. It will be appreciated if any mistakes are brought to the attention of the Secretary of the American Medical Association.

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- 1916-17 Chairman, Francis P. Emerson, Boston.
Vice-Chairman, Greenfield Sluder, St. Louis.
Secretary, Lee W. Dean, Iowa City, Iowa.
Delegate, Robert Levy, Denver.

CONTENTS

	PAGE
List of Officers.....	7
Proceedings of the Section.....	11
Chairman's Address; Acute Purulent Infections of the Nose, Throat and Ear. Our Responsibility to the Public. Hill Hastings.....	17
Xanthosis and Other Septal Hemorrhages. Chester C. Cott.....	25
Further Observations on the Connellan-King Diplococcus Throat Infections; Their Sequelae, with Especial Reference to Arthritis. James Joseph King.....	33
Thyroid Disease in Relation to Rhinology and Laryn- gology. B. R. Shurly.....	45
External Frontal Sinus Operation. Joseph C. Beck.....	55
Intranasal Surgery for Relief of Chronic Frontal Sinusitis. Lee M. Hurd.....	67
Empyema of the Ethmoid Cells. George F. Cott.....	74
The Surgery of the Ethmoid Labyrinth. George E. Shambaugh.....	79
The Surgical Treatment of Chronic Maxillary Sinusitis. William E. Sauer.....	86
The Sphenoid Sinus. A Review of the Past with Sugges- tions for the Future. Hanau W. Loeb.....	92
Sphenoid Sinus. Present Day Value of Surgical Pro- cedure. Rose Hall Skillern.....	99
The Oblique Method of Roentgenography of the Ethmoid and Sphenoid Cells. Samuel Iglauer.....	121
✓ The Prevention of Chronic Middle Ear Suppuration. George W. Mackenzie.....	135
Nonoperative Treatment of Otitis Media. Norval H. Pierce.....	146
The End-Results of Treatment of Chronic Suppurative Otitis Media. John F. Barnhill.....	153
The Mastoid Operation of Ten Years Ago and of Today. Brief Estimate of the Advance as Measured by Practical Results. Philip D. Kerrison.....	168
Vaccine Therapy. Its Possibilities and Limitations. David John Davis.....	184
Clinical Experience with the Use of Vaccines in Diseases of the Ear, Nose and Throat. George Morrison Coates.....	194
The Possibilities and Limitations of Nonsurgical Bron- choscopic Treatment. Robert F. Ridpath..	212
The Possibilities and Limitations of Suspension Laryn- gscopy. Robert C. Lynch.....	223

CONTENTS—Continued

	PAGE
Mechanical Problems of Bronchoscopic and Esophago- scopic Foreign Body Extraction. Chevalier Jackson..	227
External Nasal Deformities; Correction by Subcutaneous. Method. Lee Cohen.....	248
Clinical Types of Labyrinthitis with Comments on Treat- ment. Wendell C. Phillips.....	257
Differential Diagnosis Between Purulent Labyrinthitis and Cerebellar Lesions. Isidore Friesner.....	268
The Importance of Aural Symptoms in the Early Diag- nosis of Tumor of the Cerebellopontile Angle. Wells P. Eagleton.....	274
The Method of Tonsillectomy by Means of the Alveolar Eminence of the Mandible and a Guillotine After Six Years' Employment. Greenfield Sluder.....	288
List of Fellows Registering in This Section.....	307
Index	321

PROCEEDINGS OF THE SECTION

TUESDAY, JUNE 13—AFTERNOON

The meeting was called to order at 2 o'clock by the chairman, Dr. Hill Hastings, Los Angeles.

Dr. Hastings read the chairman's address, entitled "Purulent Infections of the Ear, Nose and Throat: Our Responsibility to the Public."

Dr. Chester C. Cott, Buffalo, read a paper on "Xanthosis and Causes of Septal Bleeding." Discussed by Drs. Emil Mayer, New York; Henry B. Hitz, Milwaukee; George F. Cott, Buffalo; Cullen F. Welty, San Francisco; C. M. Brown, Buffalo, and Chester C. Cott, Buffalo.

Dr. James J. King read a paper by himself and Dr. John J. Conellan, New York, on "Further Observations on the Connellan-King Diplococci Throat Infections and Their Sequelae, with Especial Reference to Arthritis" with lantern demonstration. Discussed by Drs. John J. Connellan, New York; Emil Mayer, New York; Virgil P. Gibney, New York; Isaac H. Jones, Philadelphia; George F. Cott, Buffalo, and James J. King, New York.

Dr. Thomas E. Carmody, Denver, read a paper on "Cleft Palate and Hare Lip" (lantern demonstration), with presentation of a case of cleft palate by Dr. Burt R. Shurly, Detroit. Discussed by Drs. Charles H. Oakman, Detroit; John F. Barnhill, Indianapolis; William W. Carter, New York, and Thomas E. Carmody, Denver.

Dr. Greenfield Sluder, St. Louis, read a paper on "The Method of Tonsillectomy by Means of the Alveolar Eminence of the Mandible and Guillotine." Discussed by Drs. G. Hudson Makuen, Philadelphia; George Paull Marquis, Chicago; W. Eugene Dixon, Oklahoma City; Eugene R. Lewis, Dubuque, Iowa; William W. Carter, New York; John O. McReynolds, Dallas, Texas; John F. Barnhill, Indianapolis; Hanau W. Loeb, St. Louis; William S. Tomlin; Indianapolis; Cullen F. Welty, San Francisco; Elmer E. Henderson, Chicago; Oliver Tydings, Chicago, and Greenfield Sluder, St. Louis.

The chairman appointed as a nominating committee Drs. Robert Levy, Denver; Burt R. Shurly, Detroit, and Norval H. Pierce, Chicago.

WEDNESDAY, JUNE 14—MORNING

Dr. Emil Mayer moved that the papers of the morning be read, that the opening discussions be given, and that further discussion be postponed until after the Bárány pictures, to be shown at 11:30. Motion carried.

The following papers were read as a symposium on "Chronic Suppuration of the Nasal Accessory Sinuses":

Dr. Joseph C. Beck, Chicago: "The Evolution of the Frontal Sinus Operation, with Special Reference to the External Operation."

Dr. Lee M. Hurd, New York: "Intranasal Surgery for Relief of Chronic Frontal Sinusitis."

Dr. G. E. Shambaugh, Chicago: "Surgery of the Ethmoid."

Dr. William E. Sauer, St. Louis: "Surgical Treatment of Chronic Suppuration of the Maxillary Sinus."

Dr. Hanau W. Loeb, St. Louis: "The Sphenoid Sinuses; a Review of the Past with Suggestions for the Future."

Dr. Ross H. Skillern, Philadelphia: "Operations on the Sphenoid Sinuses."

Dr. Samuel Iglauer, Cincinnati: "Roentgenography of the Sphenoid and Ethmoid Cells by the Oblique Method (Lantern Demonstration)."

Dr. George F. Cott, Buffalo: "Ethmoid Empyema: Acute and Chronic."

These eight papers were discussed by Drs. H. P. Mosher, Boston; Lee Cohen, Baltimore; H. Y. McNaught, San Francisco; Francis W. Alter, Toledo, Ohio; Joseph C. Beck, Chicago; George F. Cott, Buffalo; G. E. Shambaugh, Chicago, and Samuel Iglauer, Cincinnati.

WEDNESDAY, JUNE 14—AFTERNOON

The following papers were read as a symposium on "Chronic Suppurative Otitis Media":

Dr. George W. Mackenzie, Philadelphia: "Chronic Middle Ear Suppuration."

Dr. Norval H. Pierce, Chicago: "Nonoperative Treatment of Otitis Media."

Dr. John F. Barnhill, Indianapolis: "End-Results of Treatment of Otitis Media."

These three papers were discussed by Dr. Francis T. Emerson, Boston.

At this time the Bárány pictures were shown, giving tests of vestibular apparatus.

Dr. Emil Mayer, New York, moved that a vote of thanks be extended to Dr. Isaac H. Jones, Philadelphia, for presenting these pictures, and that his remarks be incorporated in the transactions of this section. Motion carried.

The three foregoing papers were further discussed by Drs. W. E. Dixon, Oklahoma City; Cullen F. Welty, San Francisco; Emmett L. Jones, Cumberland, Md.; J. Holinger, Chicago; A. E. Prince, Springfield, Ill.; H. B. Harris, Dayton, Ohio; W. S. Tomlin, Indianapolis; Charles M. Robertson,

Chicago; Clark W. Hawley, Chicago; George W. Mackenzie, Philadelphia; Norval H. Pierce, Chicago, and Joseph C. Beck, Chicago.

Dr. Philip D. Kerrison, New York, read a paper on "The Mastoid Operation of Ten Years Ago and Today: Gradual Changes in Operative Methods and Technic. Brief Estimate of the Advance as Measured by Practical Results." Discussed by Drs. R. B. Canfield, Ann Arbor, Mich.; Cullen F. Welty, San Francisco; Joseph C. Beck, Chicago; Wendell C. Phillips, New York, and Philip D. Kerrison, New York.

Dr. David J. Davis, Chicago, read a paper on "Vaccine Therapy: Its Possibilities and Limitations." Discussed by Dr. John A. Pratt, Aurora, Ill.

Dr. George M. Coates, Philadelphia, read a paper on "Clinical Experience with Use of Vaccines in Diseases of the Ear, Nose and Throat." Discussed by Dr. Daniel W. Layman, Indianapolis.

THURSDAY, JUNE 15—MORNING

The meeting was called to order at 9:15 by the chairman, the first order of business being the report of the Nominating Committee. This committee offered the following names for consideration: chairman, Dr. Francis P. Emerson, Boston; vice chairman, Dr. Greenfield Sluder, St. Louis; secretary, Dr. L. W. Dean, Iowa City, Iowa; representative in House of Delegates, Dr. Robert Levy, Denver; alternate, Dr. Elmer L. Kenyon, Chicago.

Moved and carried that the report of the Nominating Committee be accepted as read and that Dr. John J. Kyle of Los Angeles cast the ballot of the entire section for the names read. Motion carried.

The report of the Committee on Teaching Oto-Laryngology, was read by Dr. Robert Levy, chairman of the committee. Moved and carried that the report be accepted.

The chairman appointed Dr. H. P. Mosher, Boston, to fill the vacancy on this committee caused by the death of Dr. Ballinger.

The chairman appointed as an obituary committee, Drs. Joseph C. Beck, Chicago, and R. B. Canfield, Ann Arbor, Mich., with instructions to report at the afternoon section.

The chairman appointed Drs. Ross H. Skillern and G. Hudson Makuen, Philadelphia, as a committee to frame suitable resolutions expressing the appreciation of the section for the entertainment given them by Dr. Burt R. Shurly, Detroit.

The following papers were read as a symposium on "Examination and Treatment of the Bronchi and Larynx":

Robert F. Ridpath, Philadelphia: "The Possibilities and Limitations of Nonsurgical Bronchoscopic Treatment."

Robert C. Lynch, New Orleans: "Possibilities and Limitations of Suspension Laryngoscopy."

These two papers were discussed by Dr. W. B. Chamberlin, Cleveland.

Dr. Chevalier Jackson, Pittsburgh, read a paper on "New Solutions of Mechanical Problems of Foreign-Body Bronchoscopy," with lantern demonstration. Discussed by Drs. Thomas Hubbard, Toledo; Samuel Iglauer, Cincinnati; H. P. Mosher, Boston; Ross H. Skillern, Philadelphia; George F. Cott, Buffalo; W. E. Dixon, Oklahoma City; George F. Keiper, Lafayette, Ind.; Robert H. Good, Chicago; Lee Cohen, Baltimore; J. W. Murphy, Cincinnati; W. R. Butt, Canton, Ohio; Robert F. Ridpath, Philadelphia, and Chevalier Jackson, Pittsburgh.

Dr. Lee Cohen, Baltimore, read a paper on "Correction of External Nasal Deformities by Subcutaneous Method (Lantern Demonstration)." Discussed by Drs. W. W. Carter, New York; Elmer L. Kenyon, Chicago, and Lee Cohen, Baltimore.

THURSDAY, JUNE 15—AFTERNOON

From 1:30 until 2 o'clock opportunity was given members to present instruments, etc.

Dr. George F. Cott, Buffalo, presented an instrument to prevent snoring. This is an attachment to the nose-piece of eyeglasses.

Dr. Joseph D. Heitger, Bedford, Ind., presented a modification of Beck's tonsil instrument, providing better control of the instrument.

Dr. Frank C. Todd, Minneapolis, presented a tonsillectomy forceps which bites, not up and down as the ordinary forceps, but in the other direction.

Dr. Albin M. Painter, Youngstown, Ohio, presented an arrangement of ring to steady the carrying light on the nasal pharyngoscope to be used in removing the posterior tip under direct inspection.

Dr. R. E. Mercer, Detroit, showed a tube which is used for drain in the antrum.

Dr. Samuel Iglauer, Cincinnati, presented a "bronchioscope," a small tunnel which corresponds to the light carrier on the Jackson tube.

Dr. A. E. Rector, Appleton, Wis., showed a frontal sinus curet.

Dr. Robert Sonnenschein, Chicago, showed a small flexible hearing tube.

Dr. Clark W. Hawley, Chicago, presented an aluminum hearing fan.

Dr. Wendell C. Phillips, New York, read a paper on "Clinical Types of Labyrinthitis, with Comments on Treatment."

Dr. Isidore Friesner, New York, read a paper on "The Differential Diagnosis Between Purulent Labyrinthitis and Cerebellar Lesions."

Dr. Wells P. Eagleton, Newark, N. J., read a paper on "The Importance of Aural Symptoms in the Early Diagnosis of Pontile Cerebellar Angle Growths (Lantern Demonstration)."

These three papers were discussed by Drs. Horace Newhart, Minneapolis; I. H. Jones, Philadelphia; J. Holinger, Chicago; George W. Mackenzie, Philadelphia; L. Fisher, Philadelphia; Isidore Friesner, New York, and Wells P. Eagleton, Newark, N. J.

The following resolution was presented:

The Section of Otolaryngology of the American Medical Association desires to express its appreciation of the generous hospitality of Dr. Shurly and the other Detroit members during the session, and also to express its thanks to the management of the Hotel Statler for the excellent provisions made for the scientific proceedings.

The following resolution was presented by the obituary committee:

WHEREAS, The following members of this section have been called from our midst by death; and

WHEREAS, The loss of these worthy and distinguished gentlemen is keenly felt by the section and by the profession in general; be it

Resolved, That we, by rising, pay deference to the memory of William Ballinger, John O. Roe and John R. Fletcher; be it further

Resolved, That a copy of this resolution be spread on the minutes and that the Secretary be instructed to notify the families of the deceased of this action.

Dr. Burt R. Shurly, Detroit, read a paper on "The Relation of the Ductless Glands to Rhinology." No discussion.

ACUTE PURULENT INFECTIONS OF THE NOSE, THROAT AND EAR

OUR RESPONSIBILITY TO THE PUBLIC *

HILL HASTINGS, M.D.
LOS ANGELES

In opening the proceedings of this section I must in the beginning express to you my grateful appreciation of the high honor bestowed on me in the selection of myself at the San Francisco meeting as chairman of this section. I realize that the honor is not altogether a personal one, but is in recognition of the good work being done in laryngology and otology by my colleagues on the Pacific coast.

The occasion of the chairman's address to this section offers, it seems to me, an opportunity to deal in a general way with some of our special problems. I wish to direct your attention to some practical phases of the problem of the care of acute, purulent infections of the ear, nose and throat. Especially I desire to point out how we may increase our efficiency to the general public, and to the general medical profession. It is not my purpose to go into the problem of acute and chronic tonsil infections. I do not flatter myself that I am offering anything that is new to you; but I hope that I may be able to summarize your own and my own practical experiences, that the attention of the general medical profession may be aroused more fully to the importance of putting into practice preventive measures in diseases of the ear, nose and throat. We should not lose sight of the fact that our efficiency to the general public depends as much, and perhaps more, on our being able to prevent purulent infections, and to

* Chairman's address.

minimize the complications from purulent infections of the nose and throat, as it does on our skill in treating the serious complications that may result. Many of the serious complications and many of the deaths are preventable complications and preventable deaths. The general public largely depends on newspaper advertisements and a few popular medical writers for its information about the care of the ear, nose and throat. For example, a "cold in the head" is still considered a trivial complaint, and "rhinitis tablets" have taken the place once agreeably filled by sugar-coated homeopathic pellets. An "earache" is just being recognized by the public as a serious symptom, yet prompt attention is still being delayed by the use of "laudanum drops," and also delayed by the ignorant belief that "to cut the eardrum means destruction of hearing." The mastoid abscesses and deaths in every community are still not connected up with the primary cause. "Spitting" is tabooed and regulated against, but "sneezing" still occupies a polite place in the public's manners. Sputum is considered dangerous, whereas nasal secretion is regarded by the public only as disagreeable. Fresh and salt water plunges, contaminated by nasal and throat secretions, especially during epidemic periods of nose and throat infections, are far more dangerous than some other conditions for which strict health regulations are enforced. Every summer hundreds of infections of the ear, nose and throat occur from dirty plunges. Such plunges, beautifully tiled, often look immaculately clean, but in reality they are badly contaminated at certain periods and are sources of danger to those not infected and also to those already infected. Many mastoids, and some deaths, occur that should be and can be prevented by keeping people with "colds" from swimming, and especially from diving.

Therefore, one of the problems that confront us is, how to teach the public to prevent, or at least help to prevent, infections of the ear, nose and throat.

"COLDS IN THE HEAD" AND "SORE THROATS"

The general public is not aware of the seriousness of "colds," nor alive either to the preventive measures against "colds," or to the preventive measures against the serious complications arising from neglected "colds in the head." That over 90 per cent. of the cases of mastoiditis result from ordinary "colds" and "sore throats" is alone sufficient excuse for making more public our own experience in handling acute infections of the nose and nasopharynx.

There is still much discussion as to the relative values of the various etiologic factors in the production of a "head cold." That an infection is the paramount factor is generally accepted. It may be that the infecting organism cannot always be isolated. The recent experiments of Foster¹ are interesting in showing that a filterable virus, apparently free from any demonstrable micro-organisms, produced typical "colds" in 42 per cent. of 36 students inoculated. As a rule, pus organisms—the various forms of the streptococcus, the pneumococcus, the *Micrococcus catarrhalis*, the *Bacillus influenzae* and many other organisms—can be grown from the purulent nasal secretions.

The experiments of Cocks² demonstrate the importance of the etiologic factor of atmospheric changes. These two main etiologic factors, infections and atmospheric changes, drafts, etc., have been recognized by clinical experience. There are other factors, such as lowered body resistance from excessive fatigue and indiscretions in diet, tending to congestion of the mucous membrane of the nose.

Prevention.—The public is not sufficiently aware of certain preventive measures, which may be briefly summarized as follows: 1. A daily cold bath. If the

1. Foster, G. B., Jr., The Etiology of Common Colds: The Probable Role of a Filterable Virus as the Causative Factor, THE JOURNAL A. M. A., April 15, 1916, p. 1180.

2. Cocks: Experimental Studies of the Effect of Various Atmospheric Conditions Upon the Upper Respiratory Tract, Tr. Am. Laryngol., Rhinol. and Otol. Soc., 1915.

cold tub bath produces too much shock, a cold sponge bath about the face, neck, chest and shoulders may be substituted. 2. Fresh, circulating air in the bedchamber. The sleeping porch accomplishes this result. The fad for outdoor sleeping, while in the main good, can be abused, for it is our experience that some people, particularly some children, are better off indoors, especially in cold, damp weather. The attempt to "harden" children who are susceptible to bronchitis and laryngitis, by forcing them to sleep outdoors in bad weather, is especially to be condemned. Morse,³ in an instructive paper on the cold air treatment in pneumonia cases, remarks that he has seen no ill effects from cold fresh air treatment of patients with lobar pneumonia, but believes harm is done in pneumonia cases complicated by bronchitis. This has been the experience of laryngologists for a long time in regard to acute inflammations of the upper air tract. 3. Another preventive measure against "colds" is the avoidance of plunges, especially during epidemics of "colds." Plunges are contaminated at such times by the nasal secretion of those affected. The sanitary control of our college gymnasium and Y. M. C. A. plunges, various baths and athletic club plunges is a problem that is only of late being recognized. There is a widespread ignorance and complete indifference on the part of those in charge of them. A recent paper by Levine⁴ gives some facts on this subject based on the examination of the swimming pool of the Iowa State College. Frequent changes of the water of a swimming pool, at least once a week, with periodic cleansing of the bottom and sides of the empty pool with ordinary lime bleach (calcium hypochlorite) is a safe measure. Where the cost of water is such that the water must be used again, Levine recommends that

3. Morse, J. L.: The Treatment of Respiratory Diseases in Infancy and Childhood, *THE JOURNAL A. M. A.*, Jan. 8, 1916, p. 71.

4. Levine: The Sanitary Control of Swimming-Pools, *Jour. Infect. Dis.*, March, 1916.

the water be pumped into a filtration plant, the empty tank cleansed, and the water be pumped back again, and disinfected in the tank by the use of copper sulphate, one part to a million. A bag containing the copper sulphate is drawn along the surface of the water until all is dissolved, a procedure that takes about fifteen minutes. 4. Another preventive measure against "colds" is the care in handling the nasal secretion of an infected member of a household. Handkerchiefs of cheesecloth should be used as much as possible and burnt. In the early stage of a "cold" sneezing is not a harmless pleasure. 5. The use of vaccines, much lauded in various quarters to prevent "colds," has not proved of value in the experience of those qualified to pass judgment on this point.

COMPLICATIONS FROM A "COLD IN THE HEAD"

A "cold" or "sore throat" may be a simple affair; but the complications that often result are more serious and may prove fatal. A majority, probably over 90 per cent., of the cases of middle-ear abscess and mastoiditis, result directly from the ordinary "colds" and "sore throats." Nearly all the cases of suppuration of the frontal, sphenoid and ethmoid sinuses, and a majority of the cases of suppuration of the maxillary antrum, result from neglected "colds in the head." While this is well known to otologists and laryngologists, the necessity for preventive measures against these complications is not appreciated sufficiently by the general medical profession, and hardly at all by the public.

The problem of protecting the nasal accessory sinuses from infections that often become chronic depends largely on one factor, that of maintaining good drainage of these cavities during a "cold." That can be well done only when the general medical man realizes that his patients with acute nasal infection should be referred when possible to men who are doing ear, nose and throat work. Such is not generally the

custom. The rule rather is to send such patients later, after the complications have advanced to an extent that cause serious concern.

The problem of curing a large proportion of the complications, e. g, frontal sinus suppuration, largely depends on the same factor, that of good drainage, which we have of late years found can be done by conservative intranasal surgery. Drainage by the simpler surgical measures has almost supplanted the dangerous radical procedures of external operations on the frontals, antra, etc. There will be fewer long standing cases of suppuration of the accessory sinuses of the nose when it is more generally understood that a persisting nasal discharge requires prompt attention. Purulent discharge from no other organ of the body is ignored either by the general practitioner or the public. "Catarrh," "catarrhal discharge" and "remedies for catarrh" are terms that are even now as much abused and as incorrectly interpreted as "catarrh of the stomach" and "catarrh of the bowels" were the terms ignorantly used a generation ago. The "patent medicine" "catarrh cures" thrive in large part by virtue of the ignorance of the public.

The best protection against infection of the ears, especially in children, is the removal of tonsils and adenoids. It is likely no exaggeration to say that nothing has done so much to protect the ears from infections and conserve the hearing of the population now growing up to adult life, as the widespread practice of removing the tonsils and adenoid growths of children. The majority of mastoid abscesses in children occur in those whose tonsils and adenoid growths have not been removed. Also, it is noteworthy that in the infectious disease, such as diphtheria, scarlet fever, measles, etc. no form of local treatment of the nose and throat has so adequately protected the ear from purulent infections as the removal of the tonsils and adenoids prior to the onset of the infectious disease.

The best protection against further spread of purulent infection of the middle ear, as we all know, is prompt incision of the drum membrane as soon as a middle ear abscess forms. Gradually the public is being taught this fact. Nevertheless there is still considerable prejudice against opening the drum membrane. The number of mastoid operations has been greatly reduced in the last ten years, and we must certainly give credit to the two preventive measures emphasized above: (1) the removal of tonsils and adenoid growths in children, and (2) more prompt incision of the drum membrane when a middle ear abscess has formed.

The dangerous practices that tend to the spread of the purulent infections of the nasopharynx into the ear may be summarized as follows: 1. The use of nasal douches of the Birmingham glass-duct type, with the head thrown back, tends to force purulent material up the eustachian tube into the ear cavity. The same applies to snuffing salt water up the nose. 2. Forcible douching of the nose with syringes, particularly where the large olive-shaped bulb tip completely closes the nostril. Gentle douching with a small tip syringe is less harmful. 3. Blowing the nasal secretion out of the nose with too much force. 4. Swimming, and particularly diving, during a "cold in the head." There is notable ignorance on the part of the public on this point, particularly in that it is a common belief that one who has recovered from a "cold," and yet whose nose is stuffed with thick, nasal secretion, is relieved by diving in plunges and especially in salt water plunges, or in the ocean. The purulent material washed out is a danger to others; and the diver himself runs a risk of forcing some of the pus into his middle ear. Most of us have seen many cases of mastoid abscess occur from this cause every summer during the swimming season. At our large ear, nose and throat institutions, it is commonly noted that the swimming season

invariably brings on "a crop of mastoids." The advice to keep out of the water until a "head cold" is entirely cleared up cannot be too strongly impressed on the public.

These few practical preventive measures, as applied to the ear, nose and throat, obvious as they are to us, are not as well known to the general practitioner, and the general public, as we ear, nose and throat men are apt to assume. We must remember, too, that these preventive measures can best reach the public through the medium of the general medical profession.

XANTHOSIS AND OTHER SEPTAL HEMORRHAGES

CHESTER C. COTT, M.D.
BUFFALO

In discussing the question of nasal hemorrhage I wish to eliminate the general diseases which cause epistaxis. We all know that many general diseases have this symptom, such as diseases of the blood, anemia, for instance, of the heart by causing passive congestion, of the liver and kidneys by raising blood pressure, or of the blood vessels, as in syphilis. In addition, epistaxis may accompany the acute infectious diseases or there may be a hereditary tendency to it, as in hemophiliacs. We need not concern ourselves with these conditions at this time, for it is our duty to recognize them and then return the patients to the general practitioner for treatment. As nosebleed from these causes compose only a minority of the cases which come to our notice, we shall be saving time by considering by far the majority of nasal hemorrhages, those due to septal lesions.

You are familiar with the traumatic type of nasal hemorrhage, which is usually unilateral, and with that type accompanying ulcerations of the septum and perforations caused by picking the nose or by tuberculosis or syphilis. Then tumors though rare cause very troublesome hemorrhage at times. However, the most frequent cause of septal hemorrhage is that condition called xanthosis and is described by Watson Williams as a "yellowish pigmentation of the pituitary membrane as a result of interstitial hemorrhage." Of all the locations in the nose where hemorrhage occurs the anterior part of the septum is the most frequent. The

percentage, according to some authorities, is about 75. Xanthosis is as a rule the start of these lesions. Therefore, in discussing xanthosis and its cure we shall consider the most common, most persistent and the most easily overlooked disease of the nasal septum causing hemorrhage.

In its early stages xanthosis is often not recognized by the general practitioner because the bleeding is not profuse. Slight hemorrhage occurs at any time of the day or night. It is unconsciously swallowed or at night inhaled. The next day it is vomited or coughed up, giving no clue as to its source. As the disease advances blood serum covers the involved area and dries. This finally becomes large enough to be detached by forcible blowing of the nose. A slight amount of mucous membrane is torn off with each scab until eventually blood appears after blowing the nose and the source of the hemorrhage is located.

Occasionally the bleeding is quite profuse, even in the early stages, when a site near the anterior septal artery is attacked. This, however, is usually a later manifestation. The thin mucous membrane and perichondrium are ulcerated and the anterior septal artery or one of its branches is opened. Then the hemorrhage occurs three or four times a day and is profuse each time. Usually it is at this stage that the cases come to us.

On examination a yellowish spot the size of a dime is seen on the septum about half an inch from the anterior nares. It has seemed to me to be present as often on straight septums as on those deviated. Occasionally one or two spots of blood may be noticed near the center of the lesion. At times there is a steady oozing from the involved surface or from one part of it or a well marked, pulsating hemorrhage. In whatever stage we see it first very slight rubbing with cotton will open the capillaries.

The treatment in the past has to my mind secured only temporary relief. Packing has been used, daily

applications have been tried, and chemical or electric cautery has been resorted to. Some men have severed the arteries found bleeding. The first two measures are certainly not of permanent value. The cautery, although occasionally useful, causes a great deal of reaction if applied strong enough to overcome the hemorrhage. The last-mentioned method is good if the hemorrhage is confined to one spot. I wish to bring to your attention a method which was mentioned some time ago at a meeting of the American Academy of Ophthalmology and Oto-Laryngology by my father. As the subject has never come before this body I thought it advisable to describe our method, since it stops the hemorrhage immediately, never to recur.

The mucous membrane and perichondrium are raised just as in starting the submucous resection of the septum. If the hemorrhage is near the floor of the nose the periosteum of the nasal crest of the superior maxillary bone is also raised. The incision is made a quarter of an inch anterior to the lesion and the membranes are freed from attachment a quarter of an inch beyond the involved area in all directions. Then iodoform gauze is packed snugly between the septum and perichondrium. This puts the flap under slight tension and effectually prevents any hemorrhage. If the membrane and perichondrium have been eroded so that there is nothing left to raise, the edges of the ulcer are raised in the usual manner and the bare cartilage gently scraped with an elevator. Then the gauze is put in place. This is left in position two days, during which time the flap becomes somewhat thickened. If there is slight bleeding when the gauze is removed, another piece is inserted for a day. As a rule no hemorrhage occurs after the third day. When packing is no longer necessary, the flap is gently pressed against the septum and encouraged to heal over the crescent-shaped piece of cartilage which is then visible. When this has healed, hemorrhage will never occur again in that region.

If both sides of the septum are diseased, the worse side should be done first and allowed to heal before the second one is touched. Otherwise a perforation will surely result, since the cartilage on both sides of that part of the septum will be without nutrition for a short time. However, this has never occurred to us if only one side is taken care of at a time. Complete healing of the incision takes place in about two weeks. Scarlet red ointment hastens recovery somewhat. We have had only two cases in which circumstances made it necessary to operate on both sides at the same time. These patients had bled so much it was thought no more could be spared and packing was not well tolerated. Considering all sides of the question, we decided to do both sides at one sitting. Both patients made good recoveries with small crescent-shaped perforations about one-eighth of an inch wide.

I shall hand to your secretary a report of thirty-eight cases in the order in which they came to us. These are all private cases. The hospital ward cases are not included. The patient in Case 9 suddenly had a severe nasal hemorrhage. The lesion was close to the nasal crest of the superior maxillary bone. The pulsating hemorrhage was the most marked I have seen in this region. However, I operated immediately, with complete success.

In Case 10 the healing was very poor after operation. The woman was 55 years old and had no general disease. Her perichondrial flap showed absolutely no inclination to stick to the cartilage after it had once been separated. Occasionally this happens. After a Simpson tampon has been left in place for a few hours the perichondrium adheres to the cartilage. But in this one case it did not. After about three months it healed all right. There was no hemorrhage at any time after operation.

Case 31 was the worst one we had. The woman was 50 year of age and lived in the country some distance from her physician. She bled continuously for

REPORT OF CASES OF SEPTAL HEMORRHAGE WITH OPERATION

Case No.	Name	Age	Sex	History of Epistaxis	Remarks
1	O. G. P.	55	M	Slight but continuous.....	Also had Bright's disease. Too weak to get out of bed
2	J. B. N.	30	M	Bleeds readily when blowing nose.....	Bilateral
3	A. K.	25	M	.....	Unilateral
4	M. O.	54	F	.....	Unilateral
5	L. McK.	17	F	Occasionally last nine years.....	Unilateral
6	L. S.	24	M	.....	Unilateral
7	C. T.	17	F	Periodical.....	Bilateral
8	G. D.	13	F	Two or three times a day for 3 months.....	Unilateral
9	O. F. B.	30	F	Profuse, especially last 24 hours.....	Unilateral with very marked pulsation
10	J. S.	53	F	.....	Did not heal for several months
11	F. B. A.	26	F	.....	Unilateral
12	M. W.	43	F	.....	Unilateral
13	E. S.	31	M	Continuous for last two weeks.....	Alcoholic. Slight recurrence one year later
14	I. O.	32	M	.....	Unilateral
15	W. H.	30	F	Bleeds on blowing out nose.....	Unilateral
16	M. S.	31	M	Every other day for last seven weeks.....	Unilateral
17	J. S.	45	F	Frequent for a number of years.....	Unilateral
18	J. S.	69	M	Blood in sputum.....	Unilateral
19	O. H. D.	47	M	Continuous for last 24 hours.....	Unilateral
20	A. M.	57	F	For last two months.....	Unilateral
21	M. K.	29	F	For many years at menses.....	Unilateral
22	N. G.	11	F	.....	Unilateral
23	R. W. S.	41	M	Once lost 4 quarts without cessation of hemorrhage, he said.....	A male nurse; weighed 300 pounds; blood pressure, systolic, 170
24	F. W.	16	M	.....	Bilateral
25	W. H. B.	37	F	.....	Unilateral
26	M. R.	22	F	.....	Unilateral
27	J. R.	35	M	Bleeds on blowing hard.....	Vessels exposed over large area, both sides
28	J. L.	29	F	Occasionally for many years.....	Unilateral
29	J. H.	51	F	.....
30	G. A. H.	24	M	Continuous and severe for last eight days.....	
31	F. M.	54	F	.....	Two doses of coagulose given with no effect, pecking alone stopped it; no bleeding after operation
32	O. B.	17	F	.....	Very anemic; good recovery
33	H. B.	29	F	Attacks for last 20 years. Occasionally 3 attacks at night.....	Unilateral
34	O. L.	29	F	Frequent epistaxis.....	Lesion quite high on septum
35	W. S.	33	M	.....
36	R. D.	21	M	.....	Bilateral
37	Dr. R. J.	40	M	Attacks for last thirteen years.....	Bilateral; no membrane or perichondrium left on right side
38	O. B.	21	M	.....

eight days, except when her nose was packed. She finally would not stand for more packing and became so weak that she was brought to town. She had had two doses of coagulose with no effect. In the office I soon located the source of the trouble, operated on it and packed. When the lesion is situated in this region there is never any difficulty in locating the bleeding vessel and no matter how hard it is bleeding, this operation can be done immediately. This woman was sent to the hospital after operation, where she remained for a week or so. She did not bleed a drop after operation. I have seen her since and she has remained well.

This report of cases which I do not intend to read has been made as concise as possible. All the patients were operated either on one or on both sides. All healed well with the exception of Case 10 mentioned above. There were all degrees of hemorrhage, from the slightest to that which if neglected longer would have caused death. The mucous membrane and perichondrium were in all conditions, from typical xanthosis or yellowish pigmentation to ulceration. There was never a recurrence of hemorrhage except in Case 13, an alcoholic, who had a slight attack one year later.

I am well aware that there are other methods used for permanently stopping septal hemorrhage, as for instance those of Beck and Pierce; however, the method outlined here is so simple and the results obtained by it so certain, when careful after-treatment is maintained, that I feel sure you will be well repaid if you try it.

1001 Main Street.

ABSTRACT OF DISCUSSION

DR. EMIL MAYER, New York: If the object of this method is merely the elevation of the perichondrium, I would like to ask whether he could not reach the same result by injecting fluid, such as a saline solution, underneath the mucosa and thus obviate a rather lengthy operative procedure?

DR. HENRY B. HITZ, Milwaukee, Wis.: I would like to call attention to a method I have tried in cases of anterior nasal hemorrhage and that is simple ligation; by passing the threaded needle underneath the point of bleeding in the tissue and tying. I often times have been unable to get directly up against the bleeding vessel, but by taking in rather a large section of the mucous membrane I have been able to control the hemorrhage permanently. If I am able to locate the point of bleeding, one or two sutures will do the work promptly—requiring no packing and resulting in no annoying ulcerations. It has answered in every case met with in the past five years.

DR. GEORGE F. COTT, Buffalo: I fail to see how Dr. Hitz can stop every case of hemorrhage, as those described in the paper, by drawing a ligature around the vessel or the spot that is affected. The area sometimes is half an inch in diameter, and extends perhaps a little farther than you can introduce any kind of a needle. You cannot get them short enough to introduce them, and if you could you would have to take a stitch at least three-quarters of an inch in length which would be impossible. As to injecting under the membrane, in most cases there is ulceration, with pus formation involving a large area from a quarter of an inch to more than half an inch, and anything injected underneath would be lost; it could not possibly be held. Care must be taken against infection, because where the cartilage is denuded it is irritated with the elevator. In one case I tried it on one side and found the cartilage was thin and perforated, so I waited until that healed up and then raised the membrane all around it and curetted the surface. That gradually healed, and then I tried the other side. The thing to do here is to thicken the membrane, and injecting fluid will not thicken it. You must irritate it in some way in order to increase nutrition.

DR. CULLEN F. WELTY, San Francisco: I believe this operation of Dr. Cott's is quite in keeping with the best that we have, and I believe it is an improvement on everything that has been done before. However, I wish to say that there is an underlying principle of a bleeding nose that has not been touched on, and that is that when a vessel is eroded it is from this the bleeding comes, and the reason you have the bleeding is because the crust is pushed away and the vessel is again opened. Now the thing to do is to put your nose in such condition that you can deal with it in a surgical way. Dr. Mayer spoke of having trouble in dealing with nasal hemorrhage. I have never seen such a condition in the extreme, and all I have done in my years of experience and practice has been to cocaine that area thoroughly and then, depending on my discretion, use a nitrate of silver cautery or an electric cautery—according to the lesion I find. No

hard and fast tampon should be put in that nose, but strict instructions should be given the nurse to change the oil tampon every two hours. You should never allow the crust to form again, and if the oil tampon is changed every two or three hours for a period of two or three days you will have a perfect recovery, and I do not know of but one or two cases that have bled the second time.

DR. C. M. BROWN, Buffalo: I have tried this method and almost always with good results. One or two cases in which I did not get good results were cases of high blood pressure—perhaps around 240—and it was necessary to apply tampons and have the patient come back the next day. But I do not remember a case where the results were not good.

DR. CHESTER C. COTT, Buffalo: In answer to Dr. Mayer, I wish to say that I have a great deal of objection to injections for this condition, because watery fluids will be absorbed quickly, and anything solid or semisolid such as paraffin will cause obstruction of breathing. But by our method the tissue gradually recedes to its normal position, although in some cases there is obstruction of breathing on one side for a short time. I have never had it occur to me that there was too much hemorrhage in that region to operate. I have always easily located the hemorrhage and operated on that vessel. Dr. Welty's method of oil tampons very likely will work well in early cases, but in advanced cases where the ulcerations are large I should think something more radical would have to be done. I have never had but one recurrence and that was in a confirmed alcoholic

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**FURTHER OBSERVATIONS ON THE
CONNELLAN-KING DIPLOCOCCUS
THROAT INFECTIONS**

**THEIR SEQUELAE, WITH ESPECIAL REFERENCE TO
ARTHRITIS**

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The Connellan-King diplococcus is a small gram-negative organism. It was first observed in my cases in the latter part of 1914, Connellan having found it a little earlier around the roots of teeth extracted by Hasbrouck and Palmer. We have never found it outside of the mouth. There, we have found it either in a tonsillar crypt or in some sinus in the tonsillar fossae after the tonsils have been removed. Such cavities are partially anaerobic chambers. Cultures have been made from the ear, the nasal chambers, and the nasal accessory sinuses, but so far they have all been negative for this micro-organism. It grows slowly on most of the solid culture media, preferably on veal serum agar in the presence of moisture at about body temperature. It is not pyogenic, but is a powerful toxin producer. We believe it to be a local infection, nonpus-producing, highly toxic, and noninfectious for the general blood stream. Numerous blood cultures have been made from patients in whom this organism has been found, but so far all of them have been negative. Likewise, many arthritic or so-called rheumatic joints in which this focal infection was believed to be the cause have been aspirated and cultured, with negative results. In these respects it is analogous to the Klebs-Loeffler and tetanus bacilli.

The clinical appearance of the throats in which this diplococcus has been found is characteristic, if this term is permissible from the comparatively small number of several hundred cases which have been observed by the author. The color of the mucosa is purplish, distinctly darker than normal, and decidedly unhealthy in appearance. The mucosa of the nose and nasopharynx is similar in appearance. It looks lifeless and as if it had been the seat of disease for a long time. The tonsils of the patients who have suffered from the more serious complications, as rheumatism, arthritis, nephritis, and cardiac lesions, have usually been rather small and submerged, with a brownish-yellow serum exuding from their crypts. This serum has given such tonsils a distinctly moistened appearance. This clinical observation coincides with the laboratory experience that this organism grows best in the presence of moisture. Most cases in which this moistened appearance over the tonsils was found were seen by me months after the initial tonsillitis, and all of the patients consulted me because of an intractable arthritis, nephritis, or some such systemic condition that had resisted the ordinary treatment. It has also been found in the large cryptic tonsils and in some pockets in the tonsillar fossae after the tonsils have been removed.

We believe that the absorption of chemical toxins from this micro-organism is capable of producing serious pathologic lesions in the nervous system, in the heart, kidneys, joints, muscles, glands, blood and respiratory tract. These symptoms or sequelae may be so serious that life itself is endangered. All of these complications have been observed in my clinical experience with this diplococcus. Improvement and cure have followed the removal of this infection in numerous patients who had previously resorted to every known means for the alleviation of their symptoms, whether it was an obstinate asthma, arthritis, endocarditis, myocarditis, or nephritis. By this it is

not meant that every patient in whom this organism has been found has been cured, but that we have a record of at least one such case in each type in which the eradication of the focal infection by this organism has stopped all symptoms. The typical clinical history of such cases is as follows:

The patient had a tonsillitis of greater or less severity and, sometimes, even no discomfort was felt in the tonsils, but only an infection in the nose and throat was noticed. Within a few days or a few weeks, some other symptom developed. The tonsillitis or infection of the upper respiratory tract may have been so slight that it was entirely forgotten by the time the complication developed. If the complication was arthritis, or the so-called rheumatism, it usually developed shortly after the initial tonsillitis. As a rule, the severer the attack of tonsillitis the sooner have the complications manifested themselves.

At the present time we have under treatment a patient who had a severe attack of tonsillitis three years ago, with a temperature running from 101 to 103 F. Within two or three days from the onset of the tonsillitis, she developed a myocarditis. She has not been out of bed since that initial attack of tonsillitis. She has had a temperature of over 100 F. and a pulse rate of from 110 to 120 every day for the last three years. Her blood pressure is now about 105 mm. of mercury. She is helpless, not being able to sit up in bed even for her nourishment. She is sometimes so weak that she cannot hold up a newspaper before her.

The first patient in whom this micro-organism was found, associated with much contamination, had a severe chill, followed by an elevation of temperature to 105.6 F. When his urine was examined the next day, it had albumin and hyaline and granular casts. The nephritis and extreme toxemia were his only complications.

Our observation has been that if the tonsillitis is severe, the complications generally ensue quickly; if mild, they develop later, in from one to eight weeks. In our own patients, who have been seen during the initial attack of tonsillitis and treated with vaccines, no complications have developed after the treatment was commenced. The complications have developed in all cases without a chill at the onset. As just stated, one patient with this infection, associated with a mixed infection of the accessory sinuses and tonsils, had a severe chill at the outset. This, however, has been the only patient who had such a chill.

The prognosis of acute tonsillitis in which this organism is believed to be the causative factor varies greatly with the treatment. All of my patients with acute forms of the disease who have been treated with autogenous vaccines have been relieved of all symptoms, and no complications or sequelae, such as arthritis and rheumatism, have developed. The tonsillitis in patients who have been treated in this manner made unusually rapid recoveries. Some of the acute cases have had nephritis and arthritis, but this also has been cleared promptly by the treatment.

On the other hand, I have seen many patients in consultation, long after the initial tonsillitis, who called on me because of some obstinate complication, as arthritis or some cardiac conditions, and this organism has been found in the tonsils as long as five years after the initial sore throat from which the trouble dated. Many such patients have been relieved by the administration of autogenous vaccine and enucleation of the tonsils, as the case reports will show.

We are therefore led to believe that some of these complications might have been averted by the prompt administration of the autogenous vaccine during the acute tonsillitis. The pain and swelling in arthritis or rheumatic joints in a considerable number of cases of from one to five years' duration have been relieved by this treatment. In some cases in which great

changes or bony ankylosis and exostoses have taken place in the joints, the treatment has stopped all evidence of activity, as pain, redness, and swelling of the soft tissues, leaving only the deformity. In a group of cases in which in addition to the joint symptoms there were cardiac and renal changes, great improvement in these conditions has taken place.

The symptoms, complications, and sequelae of this infection can best be described by reciting cases which illustrate types. These will follow after a few words on the treatment in a general way.

Treatment.—This consists in eliminating the infection. So far as we know at the present time, the focus is situated within the mouth, either at the root of a tooth or in a crypt of the tonsillar fossae. A culture is taken from the patient, and if it proves positive an autogenous vaccine is made. It is prepared so that 1 c.c. represents 200 millions of the diplococci. The vaccine is given three times a week until all activity of the infection has ceased, and then if the focus is in the tonsils, they are enucleated, unless there is some contraindication. Patients whose teeth need attention are referred to a competent dentist for appropriate treatment.

We believe that the administration of the autogenous vaccine not only stops the activity of the organism by overcoming the effect of the absorption of its toxins, but that it renders tonsillectomy a safer and more satisfactory operation. Frequently after a tonsillectomy there is a low-grade sepsis, which is not only annoying to the surgeon, but also may endanger the patient's life. For instance, we have seen several patients whose tonsils were enucleated for the relief of rheumatic pains immediately have a subacute exacerbation of the attack, which continued indefinitely, and the disease for the relief of which the tonsils were removed was not helped. My experience with the autogenous vaccine treatment of these patients leads me to believe that much of the trouble can be averted by their use as a preliminary step to the operation.

As there has been no precedent in the dosage of this vaccine, we have had to feel our way as we went along. The dosage of even well-known micro-organisms has not been definitely established. As first, 200 millions of the diplococci were given subcutaneously every four to seven days, and gradually increased according to the indications to be met and the reactions obtained. For some time now, 200 millions have been given three times a week. The dosage has varied according to the individual to be treated. In the aged and debilitated and in young children the initial dose has been much smaller and was gradually increased according to the reactions. If a severe reaction is produced in any one case, the dosage is reduced, and vice versa. The reactions manifest themselves usually by an elevation of temperature of one or two degrees, local pain and redness, slight pains over the body, and frequently by a slight exacerbation of symptoms. As a rule, these reactions become less and less until none are produced. In some cases the organism has persisted in the tonsil even after all symptoms had disappeared and the vaccine had been given until no reactions were produced. The reaction varies greatly with different individuals, and some patients complain of more pain in one arm than in the other.

In previous communications¹ I have reported a number of cases of arthritis, nephritis, anemia, endocarditis, and myocarditis in which the Connellan-King diplococcus was the causative factor. These patients have all been treated within the last two years, and it is now my purpose to add a further report on these cases.

REPORT OF CASES

The first patient who was reported in the preliminary report was treated in November, 1914. He had at that time acute tonsillitis and nephritis. All symptoms disappeared under

1. King: Abstract of a Preliminary Report on the Connellan-King Diplococcus Infections of the Throat, *Laryngoscope*, 1915, xxv, 229; The Connellan-King Diplococcus Infections of the Throat, with Especial Reference to Rheumatism, *Med. Rec.*, New York, 1915, lxxxviii, 958.

the vaccine treatment. He had a recurrence of tonsillitis in March, 1915. He received more vaccine, but his tonsils were not enucleated. He made a rapid recovery from the tonsillitis. At the present time he is well and has had no recurrence of the nephritis.

Another patient mentioned in the preliminary report, and reported again later, consulted me in December, 1914, for the relief of a severe arthritis following an attack of tonsillitis ten months previously. She was relieved of all active symptoms by seven injections of the autogenous vaccine. In March, 1915, she returned to me for a tonsillectomy. At that time cultures made from the crypts of the tonsils again showed Connellan-King diplococci. She had, however, no symptoms either of tonsillitis or in the joints. The tonsils were enucleated and a few doses of vaccine given, but there were no reactions. She made an uneventful recovery from the tonsillectomy and has had no further activity in the joints. Her right knee is ankylosed, but she has no pains and can walk without the use of a crutch or stick, whereas when she first consulted me she had great pain and had to use a crutch in walking.

Miss E. S., who was reported as Case 4 in a previous communication,² is perfectly well at the present time. She first consulted me about a year ago for the relief of multiple arthritis and endocarditis following a tonsillitis five years before. During the past five years, in spite of treatment, the arthritis was progressive, and this, coupled with her cardiac condition, incapacitated her for work. During the summer of 1915 she received vaccine treatment and her tonsils were enucleated. The conditions were relieved promptly. At the present time she is well, although her joints still show a slight deformity. Her heart has a slight murmur, but it is so much better that the damage can be detected only by a very careful examination. Her general condition has improved greatly, and she has been attending to her usual duties for the last six or eight months.

The following new case is very striking and is typical of a considerable number in my private records:

Miss D. C., aged 21, was seen by me in consultation April 2, 1916. Twelve weeks previously she had had a severe tonsillitis. A few days later she developed rheumatism in nearly all the joints of her body. The tonsillitis soon disappeared under the usual treatment. During these twelve weeks she was confined to bed under the constant care of her family physician, nurses, and various consultants. Her range of temperature was from 101 to 104 F. When I entered her room her condition inspired me with the greatest pity. She was

2. Second reference of Footnote 1.

lying there in bed with her arms folded over her chest in great pain, and she said, "Don't touch me." The fingers, elbows, knees, and toes of both sides were swollen, red, and exquisitely painful. Her heart action was very rapid, and while no murmur could be detected at that time, one was expected to appear at any examination. She had been treated with all the usual remedies without effect, and opiates were given to control the pain.

A culture was made from the crypts of her tonsils. It showed a pure culture of the Connellan-King diplococcus. An autogenous vaccine was prepared and was given by her physician three times a week. All other treatment was stopped when the administration of the vaccine was commenced.

As a result the temperature came down within a few days and the heart action improved remarkably and rapidly. The pain and swelling in the joints disappeared with equal rapidity. About three weeks from the time the culture was taken from her throat I saw her again, and she was in splendid condition. She was up and going about as usual, had no pain in the joints, and felt splendidly. It was most gratifying to see her so well and happy.

If space permitted, a great many more cases could be reported, but these are sufficient to illustrate types.

CONCLUSIONS

A study of these cases enables us to reach the following conclusions:

1. The frequent presence of the Connellan-King diplococcus in the crypts of the tonsils or at the roots of the teeth in arthritic patients suggests that it may be specific, and that a simple tonsillitis may be followed by very serious complications, due to an absorption of chemical toxins.

2. The danger of a general sepsis following tonsillectomy might be eliminated if a culture were taken from each patient.

3. If the focus of infection in arthritis exists in the tonsil, the treatment should consist in the injection of an autogenous vaccine until all infection is cleared up and then the tonsils should be removed by enucleation.

4. The blood changes in the Connellan-King diplococcus infections seem to be a simple anemia and, in a few cases, a slight increase in the eosinophils from 4 to 6 per cent.

5. In some cases symptoms other than those for which treatment was instituted have disappeared. For instance, in one patient with arthritis and marked ethmoiditis the culture was obtained from the throat. Within two weeks the ethmoiditis had cleared up, while the arthritis was only slightly relieved. Another patient with serious gastric disturbance, who had found it necessary to remain on a strict diet, was able to eat almost everything after she had received the treatment with the autogenous vaccine.

All the laboratory work has been done by Mr. John J. Connellan, and I take great pleasure in expressing my appreciation of his valuable assistance.

40 East Forty-First Street.

ABSTRACT OF DISCUSSION

DR. JOHN J. CONNELLAN, New York: About two years ago, Drs. Hasbrouck and Palmer of New York asked me to examine their extracted teeth and ascertain if *endamoeba buccalis* was present. We were unable to find the endameba in any case. As several of the cases showed abscesses, cultures were made. The organisms found were the *streptococcus viridans*, from the apex of the tooth and *S. hemolyticus* from abscesses. We also found in some of the cases a Gram negative diplococcus which I had not seen before, nor was there anything in literature calling attention to this organism. I then asked Dr. King if he would make cultures from other parts of the throat and mouth. The result of such work showed this organism present in the crypts of the tonsils and around the teeth. Since that time we have found it in numerous cases at the apex of extracted teeth, some of which were decayed and others in good condition, but in which the roentgenogram showed abscess formation. The organism is a typical bean-shaped Gram negative diplococcus. It is slightly smaller than the gonococcus when it has attained its maximum growth on its best growing media. I have been unable to find this organism outside the mouth and throat. Its best growing media is human blood agar with a little veal serum added. The main point in its growth is the reaction of the media. On not more than 0.2 per cent. acid will the organism grow. In preparing the media it is absolutely necessary to use the titration method. Litmus paper should never be depended on. It does not produce acid as produced by other Gram negative diplococci, described by Dunham, from the nose and throat. In using the Hiss sugar serums, we get no reaction except coagulation of albumin showing that it is not a gas producer; which brings to mind why when found in these apparently

good teeth with abscess formation at the apex there was no history of pain by patient. The organism is best grown at a temperature from 39 to 40 C. It has a characteristic appearance on the media, colony being a light, dull yellowish-brown with a rounded contour. The size of the colonies is approximately that of the *Staphylococcus albus*. Dunham, Van Lingelshein and Elser and others have reported several Gram negative organisms found in the mouth and other parts of the body, but this organism does not compare with any that these investigators have reported. As to the animal injection, intraperitoneal injections of guinea pigs, dogs and white mice produced no symptoms. Two cubic centimeters of sterile salt solution (a c.c. containing approximately 100,000,000), were injected into the marginal vein of a rabbit, producing death in four days. The organism was recovered in the heart. Complement fixation experiments are now being worked out by an investigator in New York City.

DR. EMIL MAYER, New York: My own experience does not entirely tally with that of the speaker in that I cannot report anything like such a percentage of cures. I had one instance which was very interesting, a nurse in the Training School in Mt. Sinai Hospital, who had been suffering for more than a year with a temperature ranging daily from 101 to 104 F., without any known cause. She came to me because her tonsils had been troubling her for some time and she wanted to have them removed, but I felt that that was not the thing to do in connection with her condition so far as this temperature was concerned. I then made a test and sent it to Dr. Connellan and he reported very promptly that it contained the Connellan-King diplococcus and sent me some vaccine. The vaccine was used and to my great delight and surprise she lost her temperature. This lasted but five days. At the end of that time the temperature went bounding on as before. This second case was that of a young woman who came to me complaining of a mastoid pain, but further examination revealed that she was suffering from a general periostitis. We found this same diplococcus-bacillus, and the result of the vaccine was all that could be desired. She got entirely well. The third case was the most interesting that has come to me, and I am anxiously awaiting the results. A gentleman complained of a rather slight pain in his throat. There was nothing much to be seen there. I looked on it as a little local infection, and made application of the usual remedies. With that he seemed to get entirely well; but in three weeks he came again with the same pain in the same place. I suggested that I take a culture, and the result was a most beautiful colony of these diplococcus-bacilli. The question is, is this one of the cases where we probably have a forerunner of an arthritis, and shall we advise the man, in spite of the fact that he has had apparently few symptoms, to go through the vaccine treatment, or shall we wait and see?

If this man should decide not to take that treatment and subsequently should develop rather a severe arthritis, I think we would be very much in the position of demonstrating that this was undoubtedly the causing factor in his arthritis.

DR. VIRGIL P. GIBNEY, New York: I had been looking for a long time on the *streptococcus viridans* in the roots of teeth or about the alveolar processes as a cause of many of the arthritides. On still further investigation I found that the Connellan-King diplococcus was a possible cause of arthritis. We have, therefore, two causes of infection in the buccal cavity, namely: *Streptococcus viridans* and the Connellan-King diplococcus. One of the cases shown by Dr. King I recall very well. It was a case of osteo-arthritis of the hip. I found restricted movements, history of a slight trauma. Having acquired the habit of looking for the cause in the buccal cavity, I found some suspicious teeth, had a roentgenogram made which confirmed my suspicions. I also found that his tonsils needed attention. Dr. King and a dentist took him in charge and he made a fair recovery. He has still a little lameness, but he suffers no pain and the outlook is very hopeful that he will be free from lameness and deformity. Confirming what the doctor has said about the progress of the cases under the use of vaccines and the removal of the focus, I wish to say that the cure of an osteo-arthritis is not always phenomenal. Recovery does not take place in a short time. You will recall that this disease is accompanied by osteophytes about the margin of the joints making movement painful and it requires some little time to get rid of these deposits.

DR. ISAAC H. JONES, Philadelphia: Dr. W. P. Conway of Atlantic City had frequent attacks of arthritis for eight years. He became progressively worse and developed a severe endocarditis and such a marked nephritis that at one time he had complete suppression of urine. His loss of weight was marked. Dr. King found his diplococcus in the tonsils, gave an autogenous vaccine and soon after removed the tonsils. Dr. Conway is now in perfect health. It seems to me that we should attribute the cure to the removal of the tonsils rather than to the vaccine, although it is important to note that the vaccine produced a marked improvement even before the tonsils were removed.

DR. JAMES J. KING, New York: The patient Dr. Mayer spoke of as having the high temperature was afterward found to have a tubercular peritonitis.

DR. GEORGE F. COTT, Buffalo: Would you get the same results in removing the tonsils after using the vaccine?

DR. KING: That is a very important point. Occasionally after a tonsillectomy a low-grade infection may continue and even endanger the patient's life. By giving the vaccine before you operate you clear up that field and operate in a clean

field and in that way avoid this danger. To be sure, we do not see these infections very often, but they come sufficiently often to give the vaccine, clear up that infection, and then operate in the interval, just as we do in appendicitis. By this means the operation is safer, and it is possible that all of these cases might be prevented if we would do this. I have had no infection following my tonsillectomies in cases where I have given the vaccine before the operation. I have sometimes found the infection still in the tonsil, but it was inactive. I had one case where the culture was taken for the second time about a year after the vaccine was given. We found the infection in the tonsil again, but there was no activity, whereas when I first saw her she had a great deal of arthritic pain and had to walk with a crutch. The vaccine stopped the activity, stopped the pain, the arthritis disappeared, she got rid of the crutch and was perfectly well when she came back to have her tonsils removed.

THYROID DISEASE IN RELATION TO RHINOLOGY AND LARYNGOLOGY

B. R. SHURLY, M.D.
DETROIT

Clinical medicine has stamped forever an indelible impression on our specialty. The trend of modern education with demand for higher standards, a longer curriculum, better teaching and more hospital work has forced on us a special training that carries us more and more into special surgical fields remote from internal medicine.

It is imperative that our training as special nasal, oral, pharyngeal and laryngeal surgeons, shall not rob us of a keen interest in the problems of diagnosis in relation to general medicine.

A few decades ago our ranks were filled by the general practitioner alone, while the higher standards of today require the development of special surgical technicians. This differentiation of specialism has progressed so rapidly that we find among us a few who devote their time exclusively to one subject, such as intubation, bronchoscopy, hay-fever.

The anatomic position of the thyroid gland, its functions, and correlations with other ductless glands places it necessarily among the subjects of great interest to the laryngologist.

As our problems of disease in the nose, throat and ear, whether surgical or medical, are dependent fundamentally on problems of immunity, infection, the action of the vasomotor centers and the influence of a balanced biochemistry of internal secretion, it is necessary that these principles of physiology and pathology, as applied to our specialty, should be constantly before us.

My particular interest in a study of the pathogenesis of internal secretion in this special field arises from the fact that the State of Michigan is within a well-defined geographic belt where thyroid disease is observed in an increased number.

Goiter, thyroid disease and the various manifestations of pathology in the ductless glands may be classified within the selected sphere of many specialties, yet it is the ophthalmologist or laryngologist who is called on for his opinion in many incipient forms of ductless gland disturbance.

The fault is no doubt ours that we fail to recognize as a syndrome the earlier signs of excessive or deficient secretion. The findings and symptoms in relation to the upper respiratory tract are of sufficient interest to attract our attention and lead to further investigation. In this connection it is frequent to find the atypical forms overlooked or passed into that graveyard of diagnoses, psychasthenia, neurasthenia, catarrh, indigestion, anemia or a run-down condition.

Scientific diagnosis and therapeutic selections of great value to the patient may be offered in appropriate atypical forms of disease.

The comfort and welfare of the patient suffering from symptoms referred to the upper respiratory tract may depend daily on the amount and character of secretion from the ductless glands. The example of hyperthyroidism with excessive secretion of the iodized protein thrown into the blood or lymph stream and the attending phenomena elicited are common observations.

Under the marvelous regulating functions of the vasomotor centers, the various ductless glands may undergo a compensatory hyperemia or hypertrophy, singly or in harmony with two or more correlated glands. The thyroid in particular is frequently disturbed in ratio with the adrenal. The simple goiter of girls at puberty, with disturbed emotional states attending an insufficient iodine feeding, is an example of transitory influence.

The exacerbation at the menstrual period with hysterical or neurotic throat symptoms is frequently called to our attention. While this condition is usually passing and remedied by rest and outdoor life, the simple goiter is occasionally a forerunner of serious thyroid trouble in later life.

It is manifestly obvious that the physiology of the thyroid and other ductless glands is profoundly affected by toxic disturbances in general and especially by those that enter the tonsillar chain of lymphatics.

We are familiar with the increased consumption of oxygen in thyroid or adrenal feeding and the effects on the heart centers and metabolism. The average amount of iodine in the normal thyroid is estimated at 3 mg. per gram of gland substance; to utilize it is not to destroy it, as iodine is reabsorbed in a process of auto-activity. It is especially our function as laryngologists to realize the direct and definite physiologic and pathologic relation of the tonsils to the thyroid and to establish a routine investigation of the effects of tonsillitis, quinsy and other infections of lymphoid tissue on the upper respiratory tract. My attention was called to this subject by the beneficial results of a series of tonsillectomies for the relief of recurrent tonsillitis and quinsy, attended by incipient typical and atypical exophthalmic goiter. The prompt, permanent and prophylactic value of enucleation in this class of cases adds another definite indication to surgical procedure which is given no attention in the literature. As acute and chronic tonsillitis and peritonsillar abscess are recognized as important etiologic factors in incipient exophthalmic goiter, tonsillectomy may be classified then as a prophylactic measure in our new and fashionable department of preventive laryngology.

While it is the purpose of this paper to limit a discussion to the thyroid gland and its relation to the upper respiratory tract, a fascinating and scientific field of research is developing in contributions to the interrelation of the tonsils with the adrenals, pituitary body, thymus and ductless gland system in general.

The diagnostic signs of differentiation according to the degree of hyperthyroidism or hypothyroidism established have been definitely classified by Beebe and Rogers as follows:

Hyperthyroidism.—More common in young women from 18 to 30 years. Onset may be slow and gradual or sudden and acute. Tachycardia from 128 to 180; pounding beat felt over a wide area; often a loud systolic murmur over apex, base and along the great vessels. Irregular form, and very susceptible to the effects of exercise. Blood pressure variable, generally low, pulse soft and full, marked dyspnea on slight exertion. Marked edema of legs.

Nervous System.—Fine tremor affecting nearly all the muscles, twitching and occasionally spasms. Patients are abnormally irritable and excitable, apprehensive, mentally very active and physically restless. Muscular weakness prominent.

Eye Signs.—Exophthalmos generally present, although it is not invariable. Occasionally unilateral, corresponding to the side having the enlarged thyroid lobe. Various symptoms arise in consequence of the exophthalmos. No pupillary changes.

Gland.—Enlargement varies from nothing to very large goiter. The blood vessels over the gland are generally much enlarged and pulsate markedly. Right lobe generally the larger.

Nutrition.—Severely disturbed; in most cases there is a loss in weight which may progress to extreme emaciation. Appetite variable; vomiting and diarrhea frequent complications. Patients drink a great deal of water.

Skin.—Profuse perspiration, erythema, urticaria, dermatographia; pigmentation, which may occasionally be so marked as to suggest Addison's disease. Hair falls out, but is not coarse and dry. Patients prefer thin clothing and cold rooms. They are more comfortable during cold weather. Temperature may be only slightly elevated, 99 to 100. In severe acute cases it runs often to 102 or 104.

Urinary Findings.—In most cases normal in volume; glycosuria not unusual; polyuria often observed in later stages. Nitrogen proportions show a very much decreased creatinin excretion, while creatin is present in large amounts. Nitrogen is marked during the period of emaciation. Blood: Hemoglobin low. Leukopenia in severe cases, with a marked relative lymphocytosis. Menses very irregular or completely suppressed.

Hypothyroidism.—More common in advancing years from 35 to 50. Onset slow and gradual, in many cases engrafted on an old Graves' disease. Heart, rarely above 100, may be

irregular, with heaving impulse. Pulse generally shows high tension and the blood pressure is above normal. Nervous system: Patient may have some tremor and muscular weakness is likely to be very pronounced, but there is not the same restlessness and jactitation. Patients are occasionally irritable, but they are generally dull and apathetic; mentally slow; memory defective. Pains in joints frequent, and referred to as rheumatism; there is a marked tendency toward sudden giving way of the legs when walking.

Eye Signs.—Exophthalmos is unusual, although it may have been present at one time. Gland: Often no enlargement can be made out; when there is a goiter it has an elastic, rubber-like consistence, occasionally cystic and nodular, but very distinctly different from the active pulsating gland of exophthalmic goiter.

Nutrition generally not seriously disturbed; patients hold their weight and in most cases gain slowly; constipation, rather diarrhea and flatulency a troublesome habit. Patients do not drink much water. Skin dry, may be scaly; patients do not perspire on exertion; hair and nails dry, brittle, and scalp scaly. Pigmentation not common. Patients prefer thick, warm clothing and are cold most of the time. Much more comfortable during hot weather. Temperature subnormal, may reach as low as 95. Urinary findings: Albuminuria is not unusual. Nitrogen proportions do not show so marked a disturbance in creatinin and creatin ratios. In large number of cases urine practically normal. Blood: Hemoglobin low, white blood count normal. Menses generally regular but scanty.

While the degree of hyperfunction is in no relation necessarily to the size of the thyroid, it is interesting to note that the family tendency, as brought out in the hereditary story of thyroid, cardiac or nervous disease, is frequently an important influence. The history of infection, shock, fright, overwork, great fatigue, mental strain, worry, or accident, will often mark the onset of an atypical or severe exophthalmic goiter.

As laryngologists, we are ever alert to the influence of systemic disease on the structures within our chosen fields of observation, yet we are prone in the hurry of routine office work to thrust aside deeper investigation. The unstable vasomotor nervous system, gout, rheumatism, neurasthenia and auto-intoxication, especially, render the subject liable to annoying symptoms in the nose, throat or ears.

Some of these cases may be classified and identified as thyroparathyroid insufficiency and appropriate treatment may be given with relief. We recognize marked cases of cretinism, infantilism and exophthalmic goiter or senility, for example, without difficulty, but the considerable number of atypical forms of disease of the ductless glands with perverted secretions and attending pathologic change and discomfort in the nose and throat pass frequently without further investigation.

Attending enlargement of the thyroid, the rhinologist is called on to recognize or suspect tumor of the hypophysis or change in the anterior or posterior lobes. As Sajous has stated, it is not alone in acromegaly that typical signs of impaired functions of the posterior pituitary appear, but in other syndromes directly ascribable to the adrenal system, as myxedema, cretinism, Graves' disease, and Addison's disease, which include in the aggregate the majority of organic changes of a morbid kind to which the system is liable, besides nervous phenomena.

The effects of thyroid toxemia and deficiency on the nervous, muscular and cardiovascular system are so serious that we may find special and early symptoms in the upper respiratory tract.

When the routine examination of the nose, throat and ears includes the cervical and postcervical glands, thyroid and thymus, it may be possible to abort an incipient case of Graves' disease or of pulmonary tuberculosis. These conditions are frequently associated with low resistance to infection.

Our observation may include the size of the hypertrophy, consistence, shape, one or both lobes, diameter of the neck, pulsation, or bruit. We may verify our suspicions before referring the case to the internist for diagnosis. The pulse will be observed as to rate, quality, arterial tension and effect of exercise. The nervous symptoms especially are those of tremor, twitching, jactitation, insomnia, dreams or disturbed

mental condition. We may also find dry or moist skin, dry, dead, or falling hair, brittle nails, pigmentation, eruptions, dermatographia, dyspnea, fatigue, nausea, and fever.

Again we may return to the symptoms and signs in detail, as observed in our special field.

In moderate or severe thyroid insufficiency we may find a dry mouth and throat increased with excessive dyspnea on exertion; voice, husky or thick, muscles of throat tire more easily; defects or changes in speech. The mucous membrane of the lips, mouth, tongue, pharynx or larynx may be swollen and dry. The laryngeal muscles may show insufficiency.

Matthews has reported 289 cases of laryngeal paralysis in 1,000 cases of goiter, seventeen of which were bilateral. In my experience a number of cases have exhibited slight motor insufficiency, according to the size of the goiter and the varying degrees of pressure. It would seem to me that as many of these cases have passing insufficiency it is scarcely tenable to term this condition laryngeal paralysis. It is quite remarkable that a change in voice is not necessarily in proportion to the degree of insufficiency.

Perversion of taste may occur. Howard observed six with abnormal taste in a series of thirty-two cases. Hume and Prudden report as high as one third abnormal after a careful testing of the sense of taste. Those occur usually in hypothyroidism.

In exophthalmic goiter taste, smell and hearing are rarely affected. In severe deficiency of thyroid secretion, hemorrhages from the nose, throat or gums are common. The amount of dyspnea may simulate cardiac or pulmonary disease of severe type. This modification of the oxygen supply due to the adrenal insufficiency may bring about a marked effect on the hair, nails and skin.

Dyspnea in hyperthyroidism occurs after damage to the heart muscle has occurred. In myxedema we occasionally observe an infiltration of the nasal mucous

membrane followed by thickening and occasional obstruction by a gelatinous, waxy, or yellowish secretion. This may be attended by symptoms of a cramped and swollen feeling in the throat. Pharynx and larynx may assume a bluish tinge or earlier a pale, yellowish color. Angioneurotic phenomena occur with relaxed or elongated conditions of the uvula. The interarytenoid fold may be transparent.

The dry and husky throat of Graves' disease may be attended by symptoms of cough, fever, unilateral bruit, loss of weight, precordial pain, apprehension and anemia, which may lead to a suspicion of mistaken diagnosis of pulmonary tuberculosis, and call in proper differentiation. In exophthalmic goiter hyperemia of the pharyngeal, bronchial and pulmonary mucosa is common.

The thyroid gland under hyperfunction is often hard, and in this condition gives rise to greater pressure, which is frequently the exciting cause of tracheal cough. This may be modified by change of position and improve with a softer consistency of the gland. Some of these cases exhibited periodicity in their intervals of exacerbation and quiescence.

The abnormal psychic condition of the individual on his discovery of an enlarged thyroid gland immediately assumes a serious phase of apprehension unless he is managed with great care and foresight.

As apprehension is one of the predominating symptoms, it is often possible, without very great care, to alarm these individuals and produce a serious hypochondriac condition.

In considering the therapy of thyroid disease in general, it is understood that the great majority of drugs are entirely useless except when occasionally indicated for the control of special symptoms. An enormous number of therapeutic measures have received the endorsement of many splendid physicians. It is, therefore, a question of serious consideration to know what we can do for these patients that offers something of value.

The therapeutic measures which we adopt at the present time are those selected by elimination after a study of these patients for many years. Rest and often a change of environment are absolutely essential to the ultimate control of thyroid disease. Psychic control and management, together with sedative therapeutic suggestion, is of untold value. The question of success in the treatment and recovery of incipient exophthalmic goiter will frequently depend on these two essentials.

In myxedema, and particularly in the atypical forms, great relief and permanent improvement is usually attained by a careful plan of administration of thyroid extract and iodine in carefully selected dosage of carefully selected preparations. The action of the thyroid protein is specific and within the realm of prompt observation. The secretions of the myxedematous throat and nasal passages become greatly improved, and the combination of the thyroid proteins of Rogers, the proteins of pancreas or adrenals and iodine will frequently bring about striking improvement. Proper use of the galvanic cautery, the anode electrode applied along the cervical sympathetic and the cathode applied to the neck, with a 1 ma. current gradually increased, is often attended by an improvement in the consistency and size of the thyroid.

Operative interference, either ligation or enucleation, should not be postponed in cases in which medical treatment does not show improvement after a reasonable time. The results depend greatly on the skill of the surgeon, as a number of serious results may testify. The use of hypodermic iodine or the green citrate of iron is often of great service in rendering the vasomotor system more stable. Many cases of the myxedematous type improve greatly under the administration of pure iodine. The study of the individual cases alone can definitely determine this problem.

The internal secretions and their relations to pathogenesis, physiology, and therapeutics deserve our most

serious study. The rôle which they assume as oxygen carriers and active principles of stimulation to the blood cells of the body deserve our interest. Their rôle as immunizing and sensitizing agents is worthy of increased scientific interest. Their influence as governors over the vasomotor centers and regulators of harmony in the functions of the lymphoid tissue of the throat is indeed significant.

We are unable as specialists to unravel many of these great mysteries of biochemistry. We must call on our laboratory colleagues with the spirit of research and untiring devotion to scientific investigation to solve these problems for us. Individually we can offer only our clinical mite. Yet it would seem that the laryngologist and the otologist has sufficient interest in the newer fields of organotherapy and pathology of the ductless glands to demonstrate that the thyroid and the tonsillar ring are involved in such a delicate and complex interrelationship that our special opinion in this field of research may, we hope, soon prove sufficient to call the attention of the internist, the neurologist, and the general surgeon to the fact that an examination of the nose, throat, ears and larynx is at least in all modesty worth the effort.

EXTERNAL FRONTAL SINUS OPERATION

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The closing words by Dr. O. T. Freer¹ in his recent article on the intranasal operation on the frontal sinus for the cure of chronic suppuration were as follows:

In cases where with the sinus open for drainage, marked suppuration continues after the intranasal operation, the external operation must be resorted to. Where great swelling of the lids, exophthalmos or cerebral symptoms indicate the existence of caries of the sinus wall and progress of the disease beyond it, in the form of Killians' sinusitis frontalis, the intranasal operation should not be done.

That is my belief with the exception that I should like to modify and amplify his remarks. When he says the external operation must be, I say should be done, because I have a very vivid recollection where I insisted that the external operation be performed and subsequently wished I had not been so insistent, although a cure was established. I am referring to the external deformity. Aside from the conditions mentioned above that would indicate an external operation I wish to call attention to the pathology of the frontal sinus which can be learned from good Roentgen-ray plates. This I have controlled by the histologic examination as well as the postoperative reading of the roentgenogram.

If one takes a stereoscopic roentgenogram and studies it both stereoscopically and pseudoscopically one will be able to interpret certain definite anatomico-pathologic conditions of the sinuses. For example, it is possible to differentiate an acute from a chronic inflammation; a suppurative from a nonsup-

1. Freer, O. T.: *Laryngoscope*, December, 1915.

purative affection; a cavity filled with polypi from one that is not. Likewise it is possible to diagnosticate the presence of a sequestrum or a foreign body. It is all in the judgment of shadows or degree of densities, with particular emphasis on certain definite outlines. It is impossible to cover this phase of the subject in a paper such as this, but suffice it to say that the value of the roentgenogram is very much underestimated from the pathologic point of view and I would recommend that the team work between rhinologist and roentgenologist be encouraged. So far as the anatomic side of the question of the roentgenograms is concerned, I believe we are all agreed that it is indispensable in operative work.

Pathologic Changes.—Macroscopically as well as microscopically we have the following forms of changes in the frontal sinus.

1. Simple congestion or acute inflammation of the mucous membrane lining.

2. Simple congestion or acute inflammation of the mucous membrane lining, plus acute osteitis, even necrosis.

3. Chronic infiltration of the lining membrane with myxomatous degeneration. Epithelium very much thickened with excessive secretion.

4. Chronic infiltration of the lining membrane with myxomatous degeneration. Epithelium very much thickened with excessive secretion plus superficial osteitis.

5. Chronic infiltration of the lining membrane with myxomatous degeneration. Epithelium very much thickened with excessive secretion, superficial osteitis and necrosis even to a degree of sequestration, and we may have in some places ulceration of the epithelium and true granulation formation.

6. Hyperplasia of the lining membrane with very little round cell infiltration, but myxomatous changes to a degree of polyposis. The bone is not changed at all or at most a rarefying osteitis.

7. Characteristics of tuberculosis, syphilis, malignant disease and foreign bodies, in addition to the chronic infiltrative inflammation. Bone changes are very common, especially in the syphilitic form.²

These various pathologic changes will each require certain definite methods of treatment, either surgical or nonsurgical, to bring the case to a successful issue. *The anatomy* with particular reference to the distance between the anterior and posterior surfaces of the sinus and the extent toward the temple will influence one as to the technic to be pursued. Also the outlet of the frontal sinus as to how much room is obtainable by an intranasal method of operation is important. I wish to call attention emphatically to the epithelial lining of the outlet of the frontal sinus. It does not matter how large the outlet is made, whether by an intranasal or an external operation, if the mucous membrane is entirely destroyed and the bone in any way disturbed, particularly the internal nasal crest, there will follow constriction that is liable to defeat the best operative procedure.

It must be remembered that the various bones in the region of the outlet of the frontal sinus respond differently when curetted or subjected to the burr. Whenever the region of the nasal bones at the junction of the internal nasal crest is attacked, there is a great deal more of reactionary osteitis than when the bone of the ethmoidal region is broken down. This is due to the lack of cancellous structures in the latter. In view of this fact it has been my practice to carefully avoid this region (internal nasal crest) of the frontal sinus, and rather enlarge toward the ethmoidal region, that is posteriorly and laterally, as suggested by Mosher.

In reviewing the final results from the various external operations on the frontal sinus, I would like to confine myself to my personal results or those that

2. Demonstrated by lantern and more extensively described in Transactions and reprints.

came under my observation rather than to repeat the opinions of others, trusting to the discussion to bring out any deficiency in my report.

1. *Kunt-Coakley Operation*.—In acute cases the simple external opening and draining for a short period of time in the frontal sinus region with subsequent middle turbinectomy and ethmoid curettage has given universally good results, and only in cases in which the acute condition was one of acute exacerbation of a chronic form was there subsequently a more formidable external operation necessary.

2. *Killian Operation*.—Probably no surgical procedure of the nasal accessory sinuses provoked a greater attention and discussion than this radical procedure for the cure of chronic suppuration of the frontal sinus. It must be further admitted that strictly surgically speaking, the same procedure is necessary today if one desires to speak about an absolute cure. At the same time I do not believe I am very far from the truth in stating that the radical Killian operation for the cure of chronic suppuration of the sinuses (fronto-ethmo-spheno-antrum) is seldom performed at present. In fact, the reaction came as soon as the intranasal procedures were successfully practiced and when the laity revolted against the marked deformities that resulted in the cure. My own personal experience with the Killian operation dates from 1903, when I operated on a chronic suppurative pansinusitis in a man whom I presented before the Chicago Oto-Laryngological Society, as a cured case. It was one of the first cases presented in this country so far as I have been able to find from the literature. After that I performed a fairly good number with absolutely satisfactory results, except for the deformities. This latter fact led me to develop a technic which was not to take the place of a radical cure but rather a conservative measure which I presented before this section in 1909, namely, an osteoplastic flap operation on the frontal sinus. There is one particular case of Kil-

lian operation that I would like to mention because, as I said in the beginning of my paper, it is very vividly in my mind, and because the narrative of this experience may help some one else in avoiding the performance of a bilateral Killian operation in a very large and deep frontal sinus, even in a man. This patient, a mechanic, came to me with an acute fulminating frontal sinusitis on both sides. After several weeks of drainage and intranasal surgery it became necessary to do the external operation. The patient never showed any disposition to oppose the external procedure. The Roentgen-ray picture showed a markedly pathologic, large frontal sinus on both sides. At operation I found a so-called double frontal sinus in the anteroposterior direction, but am sure it was a large bulla ethmoidalis reaching high in the region of the frontal sinus as first suggested by Logan Turner. This condition was present on both sides. After healing occurred there resulted a marked depression, although I was very careful to preserve a good supra-orbital ridge. One day while the patient called I demonstrated him as a fine result to Dr. B— of California, who was visiting me at the time. The patient expressed himself most disgusted, in fact, in a threatening manner, stating that he would get even because I made him conspicuous and a subject of ridicule in the shop where he worked. I was so impressed with this threat that I had the man watched for some time.

3. *Modified Killian Operation.*—Just before the intranasal operation became well developed or in cases in which it did not suffice, various procedures were advocated with variable results. One of the first modifications, owing to the marked diplopia resulting, was the leaving of the roof of the orbit intact, thus preserving the pulley of the superior oblique. In another instance, the nasal process of the superior maxilla was not attacked because it often left a deformity on the side of the nose and necessitated the prolongation of the external incision. Finally, less of

the anterior wall of the sinus was being removed, and by making a large opening into the nose by taking away as much as possible of the floor of the sinus, one was satisfied even though obliteration was not obtained. The criticism of these procedures is, that the lining membrane has often times been sacrificed unnecessarily because the cavity could not become obliterated and because lined by a granulation, which is not as good a nutrition to the bone as the membrane itself, even though the latter be not normal. Besides, this granulation membrane secretes a great deal more. Though less of the anterior wall is removed, there will nevertheless result depression.

4. *Lothrop's Operation*.—At the meeting last year of this section Dr. Howard A. Lothrop³ presented a procedure that according to his report meets all the requirements of curing a chronic suppurative sinusitis, especially if intranasal procedures failed and if there be an external fistula present. The procedure consists in making an opening about the size of a half dime above the inner canthus or below the eyebrow in what is known as Ewing's space, through which he enters the frontal sinus. By way of the nose and through this created opening in the frontal sinus, the internal nasal crest is removed, leaving sufficient bone in order not to get a collapse of the bridge of the nose. Then the floor of the frontal sinus is removed. Now comes an entirely new procedure, namely, the removal of the perpendicular plate of the ethmoid constituting the upper most anterior portion of the nasal septum. This removal is continued into the frontal sinus, where the septum of the same is also removed. Through the same original opening and the opposite nostril the floor of the other frontal sinus is taken away, as well as any projecting remains of the internal nasal crest. The external wound is then closed up. The result is that both frontal sinuses empty into one large opening,

3. Lothrop, H. A.: Frontal Sinus Suppuration with Results of New Operative Procedure, *THE JOURNAL A. M. A.*, June 10, 1915, p. 153.

which may discharge in either nostril; in other words, one may enter either frontal sinus from either nostril, or both sides from one nostril. My criticism is, or I should say was, that as a result of drilling the internal crest as well as the posterior surface of the frontal sinus outlet, the resultant opening would narrow, although not as much as if each sinus was operated separately, and furthermore the same criticism that I have to my own procedure, which I am about to describe, that is, if only one sinus is involved one would necessarily infect the other sinus or else this procedure could not be carried out. I say that it was my objection rather than is, because since the presentation of this subject by Dr. Lothrop, I have seen a modification tried by Dr. Richards of Fall River, Mass., and Dr. Lynch of New Orleans, which makes me feel that this procedure will find a place especially for the fistula cases. With the permission and apologies to Drs. Richards and Lynch, I will state what I saw them do and then describe my suggestion of this procedure as a result of personal experience.

Their case was one of chronic frontal sinusitis with fistula from a previous operation. Their modification was the employment of hand drills (Fig. 1) which had only cutting edges on the anterior half of the burr, the posterior being smooth, thus avoiding the destruction of the lining membrane of the outlet posteriorly, and prevented subsequent cicatrization. In a case I recently operated on I had a fistula with depression following operation, in which I performed the Lathrop operation, but avoided the internal nasal crest by protecting it with a Halle protector and using an electric oval drill. The result is very satisfactory now, eight weeks since operation.

5. *Beck's Osteoplastic Flap Operation.*—Permit me now to briefly describe the procedure which I recommended eight years ago as an external nonobliterating operation in those cases that appear to be unsatisfactory after an intranasal procedure. I might say that

I have not had to change but one thing in the technic since I first presented it before this section, and that is the avoidance of the destruction of the lining membrane of the internal nasal crest.⁴

STEPS OF OPERATION

1. Roentgenogram, postero-anterior, for proper anatomic outlines.
2. Celluloid model made from tracing of frontal sinus, from roentgenogram.
3. Incision through skin and subcutaneous tissue along the upper margins of the eyebrows, and these untied across the bridge of nose.
4. Dissection of the skin and subcutaneous tissue flap upward.
5. Celluloid model placed over exposed area.
6. Incision through periosteum along the margin of the celluloid model.
7. Chisel and burr along this lateral periosteal incision from one supra-orbital margin to the other in the interior of the frontal sinus.
8. Gigli saw engaged in the upper edge of this incision and brought down to the level of the supra-orbital margin, thus cutting the septum of the frontal sinus, then saw slightly upward to weaken the pedicle.
9. Turn this osteo-periosteal flap down. Remove the pathologic tissue, but carefully avoid exposure of bone of any great extent.
10. Enlarge outlet of sinus in the nose backward and outward by means of electrically driven burr, carefully avoiding the internal nasal crest by use of Halle protector.
11. Semisolid rubber tube inserted into the outlet, one end coming at near the nostril, the upper end at the beginning of the outlet. Through this tube a strip of prepared gauze is packed, the upper end loosely filling in the cavity of the sinus.

4. The various steps of this operation were demonstrated by lantern slides, and will be more extensively described in Transactions and reprints.

12. Osteoperiosteal flap brought back into position and the skin and subcutaneous tissue flaps brought down and sutured or closed by use of clips.

After-Treatment.—On the second day remove the gauze, on the fifth day the tube. No further drainage is necessary. Subsequently but not before three weeks, wash the sinus with normal salt solution or injection of bismuth paste into the sinus may be done.

In the criticism of the procedure I would say that if only one side is affected one may take off just the one half of the anterior surface of the sinus, that is, employ the fine burr or chisel to follow a celluloid model of just the size of the sinus to be exposed. The skin and subcutaneous flap, however, should be the same as if both sinuses were to be exposed. This is an objection in that one may infect an otherwise healthy sinus. I have no doubt that I have done this very thing several times, without any untoward results, because the procedure healed the infected sinus, and thus prevented reinfected the healthy sinus to any extent. As to exact statistics I will state that I have since 1908 performed this operation thirty-one times with an apparent cure in twenty-seven cases. In two of these four cases I operated away from home, and never heard whether they were satisfactory or not; the other two had to be reoperated, converted into the Killian. These were the early cases in which I used to make a large opening into the nose, taking away some of the internal nasal crest and in which the mucous membrane of the entire circumference of the outlet of the frontal sinus was destroyed. These reoperations would have been good cases for the Lathrop operation.

In conclusion, I would like to present the histories of the end-results of the two cases whose photographs are shown in Figure 2. It must be stated that the frontal sinus in the malformed case was evidently much larger and extended far over the orbit.

CASE REPORTS

CASE 1.—Mrs. L. started in May, 1912, with a very severe pain in the left eye which was diagnosed by two ophthalmologists as glaucoma. She then consulted a rhinologist who diagnosed, from his nasal examination, a closed off acute frontal sinus disease on the left side. He performed an anterior turbinectomy, following which there was a free escape of pus and marked relief of her symptoms. This relief lasted only about two weeks when the symptoms returned only much more stormy, accompanied with chills and a cracking sensation about her eyes. There appeared to be no improvement from the pains and discharge, so she was referred to a Chicago rhinologist to determine whether external frontal sinus operation was necessary. The latter advised an ethmoid exenteration and reopening of frontal sinus within the nose. This the attending rhinologist performed. This procedure was followed by comparative comfort for about four months, when symptoms began to return, especially a feeling of a plug formation in the front part of the head. The attending rhinologist performed a Good intranasal rasp operation on the frontal sinus. For six months following this procedure the patient was fairly free from symptoms, when they returned more severe than ever and the attending rhinologist brought the patient to me. I found the left nasofrontal passage outlet completely blocked and the x-ray picture definite of a marked diseased condition. The headaches were so persistent and severe, and there being some rise of temperature, we decided on an external operation and my osteoplastic procedure was performed. We found the entire frontal sinus was filled with a thick pyogenic membrane which proved to be so by subsequent microscopic examination. The ethmoidal region was again recuretted as well as the antrum and sphenoid explored and their natural openings enlarged. A very large opening between the frontal sinus and the nose was made by means of electric burrs. The immediate as well as the subsequent course of this case was uneventful and the patient is now perfectly well, after more than one year. I am so informed by her attending rhinologist today. The photograph (Fig. 2) was taken three weeks after operation, and shows the absence of any deformity.

CASE 2.—*History.*—Mrs. D., aged 45, suffering with chronic suppuration of the sinuses for a number of years, consulted a well known otolaryngologist of New Orleans, who had her under treatment for some time, performing the customary operations and reoperations within the nasal cavity. As the patient was still having suppuration in the nose as well as pain and headache, the physician was compelled to resort to an external operation. A bilateral frontal sinus operation according to Killian was performed. The patient did not

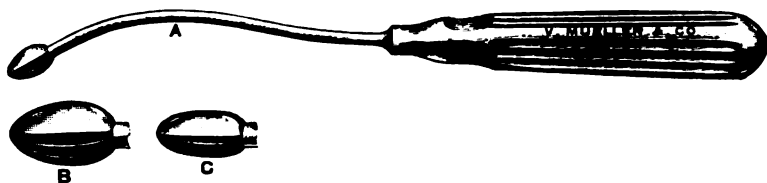


Fig. 1.—*A*, small size; *B*, large size; *C*, smooth surface.



Fig. 2.—Mrs. L. and Mrs. D.



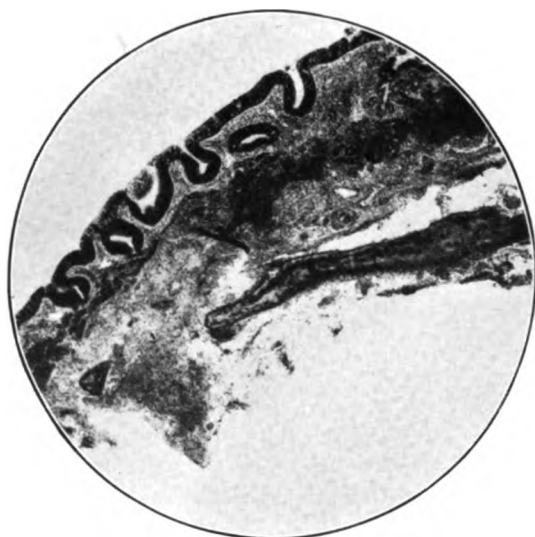


Fig. 3.—Acute inflammation with acute osteitis; marked thickening of epithelium.



Fig. 4.—Pyogenic lining membrane with thin layer of epithelium.



Fig. 5.—Pyogenic lining membrane without epithelium.

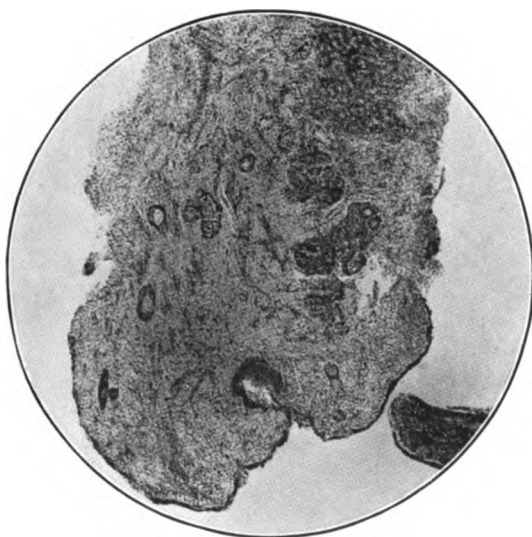


Fig. 6.—Chronic fibrous and glandular hyperplasia of lining membrane.



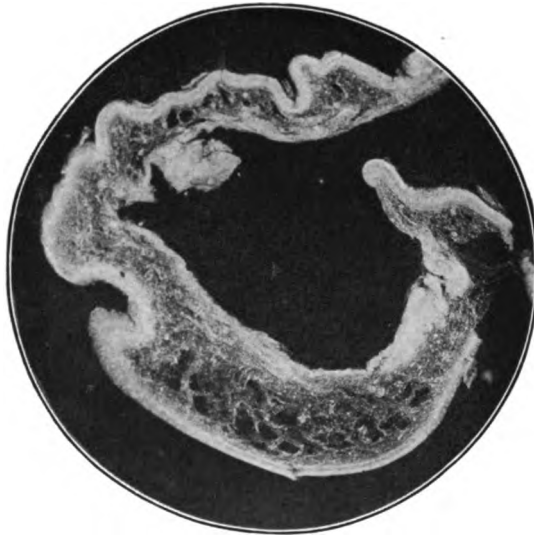


Fig. 7.—Chronic suppurative infiltration of membrane with cystic myxomatous degeneration.

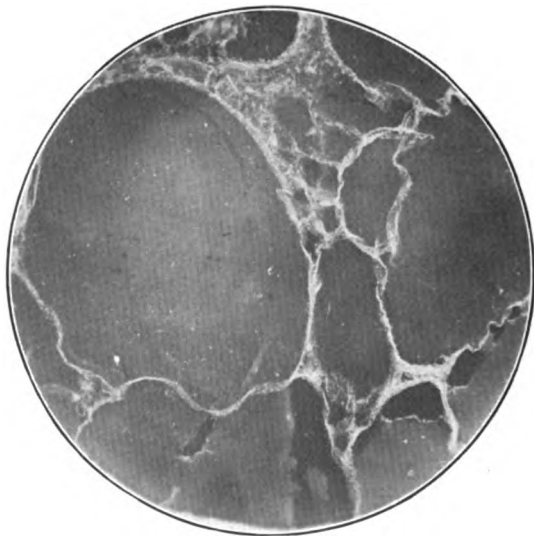


Fig. 8.—Cystic myxomatous degeneration of lining membrane.



Fig. 9.—Myxomatous or polypoid degeneration of lining membrane.



Fig. 10.—Solitary fibrous polypi in frontal sinus.



get along very well on account of retention, which made him operate a second time for the purpose of allowing the cavity to remain open and granulate from the bottom. This, however, did not take place, as whenever the external wound closed, retention would result with subsequent fistula formation.

The patient was obliged to remove to New York, and on the way consulted an otolaryngologist in Chicago who reoperated on the frontal sinus and performed a bilateral Denker operation. After apparent healing had taken place, the patient went to New York, and soon after experienced retention above the left eye with considerable pain. She consulted another otolaryngologist in New York who concluded that the patient should wear a silver cannula leading from the retention pocket into the nose, similar to the stylet worn in chronic dacryocystitis.

April 7, 1914, about four years after the last attention, she consulted me. I found a discharging fistula above the inner canthus of each eye, and in the bottom of the left fistula the small silver cannula just mentioned. A complete analysis of the case was made and an operation decided on.

The patient, however, developed an acute otitis media suppurativa requiring a paracentesis. She again returned to New York, where this condition was treated.

In October, 1914, she returned to me for operative work and I learned that in the meantime the right fistula, while closed at the time she had left me, had spontaneously opened two or three times during her present stay in New York.

Before resorting to the operation, an autogenous vaccine, an anaerobic micro-organism being particularly cultivated, was made, and injected for about three weeks. The fistula was injected with bismuth paste No. 1 in order to disinfect it. Ten mg. of pure radium element was placed within the nasal cavity in the attic region and x-rays, by the deep penetration method by water cooled tubes were applied from the outside as a crossfire. This combined vaccine, radium, x-ray and bismuth paste treatment, as well as internal administration of large doses of hexamethylenamin were given preliminary to the operation because we expected to expose such important structures as the dura and orbit, and thus lessen infection of them.

Operation.—We found, following the left fistula outward and backward, a cavity of considerable size, reaching over the orbit to the region in close proximity to the optic foramen. It seemed to pass downward and backward to its outer surface. This cavity was lined with pyogenic material which, when removed and subsequently examined microscopically, was shown to be covered with a thin layer of epithelial cells. This pyogenic material was therefore scraped,

and the bone over the orbit as well as the under surface of the frontal bone or roof of the frontal sinus of that diverticulum was removed by an electrically driven burr to its very limits. This procedure caused the exposure of the dura above and the periosteum of the orbit below. The previous operation allowed a considerable overhanging of the supra-orbital margin, and this too was removed to a marked extent, in order to have complete control of the newly made cavity. This cavity was packed with gauze for about one week until healthy granulations were lining it, when bismuth paste No. 2 was injected and the cavity allowed to heal.

Three weeks after the operation the patient was desirous of going home and I referred her to a well known specialist in Philadelphia, the condition then appearing as in Figure 2. He made the following statement in a letter to me: "Find that the wound is healing up nicely and suppuration has entirely ceased. It looks to me as though you were going to have an excellent result. I told her to return again if there was any further trouble, but believe from its appearance that everything will be well with her."

About two months later I received a report saying that she felt absolutely well and the sinus remained closed. It is my intention to do subsequently plastic work which will fill up the cavities which have deformed this patient, although cured of her suppuration.

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INTRANASAL SURGERY FOR RELIEF OF CHRONIC FRONTAL SINUSITIS

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The frontal sinus is formed from the expansion of an anterior ethmoidal cell into the frontal bone or as a direct extension of the infundibulum.

Usually there are two sinuses, but it is important to remember that one or both may be absent, and that there may be as many as four or five distinct sinuses, communicating with the nasal cavity by their own ostia.

One sinus may be underdeveloped, and the sinus of the opposite side may have expanded beyond the median line and formed part of the superior and anterior wall of the smaller one, and also an anterior ethmoidal cell may have a large orbital extension and its anterior wall bulge into the posterior part of the frontal sinus, forming the so-called bulla frontalis; and this ethmoidal cell may be the seat of disease which will simulate frontal sinus disease, while the frontal sinus is normal.

The frontal sinus may barely reach the brow, or it may extend upward fully two inches and externally, nearly three inches, and may also have a recess over the orbit, extending backward almost to its apex.

In considering intranasal treatment of the frontal sinus, the relations of the anterior ethmoidal cells and the infundibulum are as important, if not more important, than the frontal sinus itself, because inflammation of the frontal sinus rarely exists without a similar condition in the anterior ethmoidal cells; and these together with the structure about the ostium of the frontal sinus, are the practical anatomical points in the intranasal surgery of the frontal sinus.

The infundibulum, with its superior wall, formed by the bulla ethmoidalis, and the inferior wall, the process uncinatus, should be considered the guide to the anterior ethmoidal cells and the frontal ostium.

The bulla ethmoidalis contains one or more cells which extend to the orbit, and has sometimes extensions over the orbit.

The anterior expansion of the meatus medius and the infundibulum is the recessus frontalis of Killian, or better divided, according to Davis,¹ who suggested that the anterior portion of the infundibulum lateral to the processus uncinatus be termed the recessus infundibularis, into which the infundibular cells drain; and that portion of the recessus frontalis lying medial to the processus uncinatus, which forms a concavity beneath the extreme anterosuperior attachment of the concha media, be termed the recessus cochalis, into which the frontal cells drain.

This divides the anterior cells into three groups, namely bulla cells, infundibular cells, and frontal cells.

The concha media, which is a prolongation downward of the inner ethmoidal wall, especially in front, acts as a curtain, concealing the structures laterally.

If the anterior attachment of the concha media is high, the frontal cells are apt to be well developed, and if attached low, the infundibular cells are more apt to be well developed, while the frontal cells are deficient. This may be of value in determining the position of the frontal ostium.

The frontal sinus communicates with the nose, according to the origin of this sinus, namely, in 60.4 per cent., it communicates with the meatus medius and in 39.6 per cent. with the infundibulum (Davis).

In the latter class the discharge from the frontal sinus may drain directly into the antrum, the infundibulum acting as a gutter between the two ostia, and this is the class in which the antrum acts as a reservoir for the frontal discharge.

1. Davis, W. E.: *Nasal Accessory Sinuses*, 1914.

Posteriorly and externally, the ostium frontalis is usually bounded by the walls of the ethmoidal cells. The anterior boundary is formed by the anterior nasal spine which may contain a cell. The posterior part of the inner wall may be in relation with the anterior portion of the olfactory fossa, from which it is separated by a thin plate of bone. This is the most dangerous locality, and no attempt should be made to enlarge the ostium in this direction. Therefore, anteriorly, the hard bone of the anterior nasal spine is encountered, while posteriorly and laterally, the friable thin bone of the ethmoidal cell wall is encountered, backed by the hard, thin bony plate of the inner table superiorly, about 1 mm. in thickness and the lacrimal bone and os planum laterally.

Here I may add that anatomically there is no such thing as a frontonasal duct.

I hope you will understand that this is only an outline of the anatomy, as there are several sources wherein this subject can be studied to better advantage.

Roentgen-ray plates are used, not only for their diagnostic value, but also to give the dimensions of the passage from the nose to the frontal sinus through the anterior ethmoidal cells.

The width of this passage varies from 7 mm. to 12 mm. (Watson Williams²).

An intimate knowledge of the surgical anatomy of the accessory sinuses and the nose should be gained from the cadaver before any attempt is made to open the sinus in the living.

Removal of the middle turbinate is about as far as one should go unless he is familiar with the many anatomic variations and relations in this region.

In the severer types of inflammation, the external operation by one who has mastered its technical details will give surer, quicker and safer results, especially in those cases in which the frontal sinus and the ethmoidal cells have large orbital extensions. One of

2. Williams, Watson: *Jour. Laryngol., Rhinol. and Otol.*, May, 1914, p. 225.

the disadvantages of the present internal methods in severe cases is the uncertainty of results and constriction of the drainage passage into the nose, which occurs in nearly all cases a few weeks after the operation.

I am working on a flap procedure which I hope will overcome this tendency to constriction, which I will report on later.

In the internal methods in which burrs, chisels and rasps are used in this small and dangerous area, the procedure will lead to more accidents than when the sinuses are opened externally. Then, too, operating in an extensively diseased field differs greatly from the deadhouse work, as the disease has made it easier to enter the frontal sinus and also easier to invade the cranial cavity.

The types of inflammation may be divided, roughly, into two classes, first, those of polypoid degeneration, with thinning or absorption of the ethmoidal walls, and second, a thickening of the mucosa with a corresponding thickening of the ethmoidal walls.

With both types there is more or less discharge, but the discharge is more apt to be greater with the latter type.

Indications for intranasal operation are all cases of chronic sinusitis in which there are no complications. About 95 per cent. can be treated by the internal method. Contraindications are intracranial and orbital complications and fistulas, all of which should be approached by the external route.

Of the several methods used to produce drainage of the frontal sinuses, those of Ingals,³ Freer,⁴ Mosher,⁵ Vacher,⁶ Watson Williams,⁷ Halle,⁷ and Good⁸ are the most used. They all aim at the same result and nearly every one has special instruments for the purpose.

3. Ingals: *Tr. Am. Laryngol. Assn.*, 1905.

4. Freer: *Laryngoscope*, December, 1915.

5. Mosher: *Laryngoscope*, September, 1911.

6. Vacher: *Bull. Otol.-Rhinol.-Laryngol.*, 1911, Vol. 14.

7. Halle: *Arch. Laryngol. and Rhinol.*, 1914, p. 73.

8. Good: *THE JOURNAL A. M. A.*, Aug. 31, 1907, p. 753.

There has been considerable discussion about preserving the middle turbinate on the ground that the olfactory filaments on its inner surface, when divided, open a direct communication with the brain. Practically, this seems overcautiousness, as meningitis, when it occurs, starts from a perforation or fracture of the inner table.

Watson Williams, Halle, and Freer preserve the middle turbinate when possible. Mosher and Tilley⁹ remove it. Many patients will recover with removal of the anterior portion of the middle turbinate alone, but for the severer types of inflammation the frontal ostium will need enlarging, and to accomplish this the route must be through the anterior ethmoidal cells.

The size of the passage through the anterior ethmoidal cells having been determined by means of the Roentgen-ray plates, supplemented by the estimated width between the turbinal plate, medially, and the internal canthus, laterally, the middle turbinate is removed to give freer access to the infundibulum and bulla. A probe can now usually be passed into the frontal sinus, which will determine whether its ostium opens into the recessus conchalis or into the recessus infundibularis.

The bulla ethmoidalis is entered with a straight curet, breaking down its cells and then coming forward, obliterating the frontal and infundibular ethmoidal cells as far as the frontal process of the superior maxilla will allow. No attempt is made to entirely clean off the orbital wall with the curet, as puncture of this wall may lead to hemorrhage or infection of the orbit, with the resulting danger to the eye. At this point a larger opening will be found into the frontal sinus, because some of the ethmoidal cell walls had formed part of the funnel-like floor of the frontal sinus about the ostium. Now changing from the straight curet to the angular curet and forceps of Grumwald, we clean the passage out and remove the

9. Tilley: *Jour. Laryngol. Rhinol. and Otol.*, May, 1914, p. 242.

remaining ethmoidal cells, and with the angular curet we enter the frontal sinus and work forward and downward in a safe direction.

This is as large as the opening into the frontal sinus can be made, unless the anterior nasal spine is taken away. The spine varies considerably in thickness. If it happens to be thin, it can easily be broken away with Myles' draw chisel, and if thick, it may be burred out, but I find that the resulting constriction from loss of the mucosa ultimately overcomes the advantage gained at the time.

For after-treatment I apply bismuth paste, douche with aqueous solution, and apply solutions of silver nitrate and sodium chlorid.

With an appropriate syringe I force cold bismuth paste into the sinus daily or as often as the condition warrants, replacing the secretion and some of the old paste with new paste at each treatment. I have found this the most satisfactory means of reducing the discharge and the swelling of the mucosa. There is no pain in the procedure, only a slight fulness for a few minutes from the pressure of the paste. As the discharge ceases, I change from the paste to white petrolatum, which melts at 90 F., and dilutes the paste remaining, and finally douche the sinus with normal saline solution, 115 F., which removes the remaining paste and petrolatum, if there is any. In a few instances in which patients have disappeared before the paste was removed I have found it in a well sinus at the end of a year, evidently producing no irritation. In some cases in which the sinus was subsequently opened externally the paste was found in one mass, helping what little drainage was present.

Douches of antiseptic solutions have been entirely abandoned. Normal saline solution is sometimes used, but the bismuth paste seems to give quicker results.

In very obstinate cases solutions of silver nitrate can be used, increasing the strength from 1 to 5 per cent., first anesthetizing the sinus, then passing a cannula into

the sinus for the silver solution and at the same time another larger cannula into the nose for the solution of sodium chlorid and simultaneously filling the nasal cavity with salt solution and the sinus with silver solution, so that as the silver solution returns into the nose it is converted into silver chlorid and has no further action on the mucosa.

Failure of internal measures to give relief are sufficient indications to advise obliterating the sinuses by the external route.

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EMPHYEMA OF THE ETHMOID CELLS

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Empyema of the ethmoid cells may be divided into acute and chronic, and the latter usually is followed by the latent.

The mucous membrane of the ethmoid is far more sensitive than that of the nose and consequently more readily succumbs to infection or to any kind of irritant; for that reason we find it so often affected when the nose is supposed to be the actual or natural habitat. Thus the ethmoid is always affected in hay-fever or any infectious disease involving the nose.

It is difficult to speak of ethmoid empyema per se, as such a condition probably never exists, at least it has never been demonstrated, the other sinuses being more or less involved; but it does not follow that treatment directed to the ethmoid will not relieve other contiguous cells as well. Empyema in early childhood is more amenable to treatment than that of the adult because of the small area involved, as well as the ready response of the tissues of the actively growing child. In fact, recovery is so common in childhood that empyema as an entity is commonly overlooked.

The causes of suppuration of the ethmoid cells are various. They may be infected through the frontal sinus, antrum, sphenoid, orbital cellulitis, syphilis, foreign bodies or nasal mucous membrane, while the intensity of the infection varies with the virulence of the bacteria. The symptoms of a typical acute case are clogging of the nasal passages, pain which becomes intense on the slightest jar, often felt above the eyes more than elsewhere or on top of the head, dizziness

and vomiting, prostration and delirium. The pain requires large doses of morphin and occasionally chloral added to induce sleep. It lasts until the discharge begins, when it is markedly lessened and only recurs at times by jerks. In four or five days the symptoms improve, except the discharge, which continues a week or two longer, when recovery seems complete. The recovery, however, is apparent only; in a large number of cases the sinus remains hypersensitive for years after. With drainage in acute empyema the nasal mucous membrane often becomes soggy with consequent obstruction to the free passage of air; if the pus is confined, pain may be very severe. These symptoms vary somewhat, depending on the severity of the infection.

In chronic empyema the mucous membrane becomes thickened by marked formation of fibrous tissue. There is a tendency to occlusion of the ostia through swelling of the membrane due to especial tenderness and looseness of the lining membrane, round cell infiltration, gradual proliferation of the epithelium, which in some cases is absent in spots, being replaced by granulation tissue (Skillern). In chronic empyema the most troublesome symptom is usually discharge with hawking and spitting, dry secretion in pharynx and sometimes crust formation in the nose. This discharge may be thick and pasty, clinging to the postpharyngeal wall or blown out of the nose in large quantities. The most troublesome condition, however, is not during the most active suppurative stage but after the secretion has changed to mucopurulent or ceased entirely. A very large number of patients never recover completely. After suppuration has ceased, sometimes years afterwards, the most troublesome symptoms occur. Now we find the mucous membrane in the cells so thin that it can only be detected microscopically and very often in my experience is absent altogether, in fact the cell wall has the appearance of "milk white." Polypi occasionally are found within the cells.

The after symptoms induce the patient to seek the advice of the rhinologist. The most prominent symptoms we now encounter are the following: Headache over the bridge of the nose, or either side, or over the eyes and forehead, on top of the head, or base of brain. The pain descends toward the shoulder, or follows the course of some nerve branch remote from the seat of the disease. Scotoma, inability to read but a few minutes, complaint of having hay-fever all the time, hawking and spitting during cold, damp weather, want of concentration finally ending in neurasthenia. If pus is still discharging intermittently, pus cells only are found, or in some instances isolated cocci. General malaise, anemia, diarrhea, at times loss of appetite and even indican in the urine and deficiency in phosphates may be present. A most harassing symptom occasionally is cough without raising anything, which lasts four, six or even eight weeks; recurring once or twice each year. And in this condition, which I now designate latent ethmoiditis, is the time when the sensitive nerves manifest their irritability. But in a goodly number of patients we find vitality low, blood pressure below normal, heart sounds weak, especially the second. Some patients say they frequently catch cold which lasts several weeks; some sneeze periodically, others have watery discharge for days. Some complain of but one symptom, while others exhibit a number of them. They vary in intensity and degree. Comparatively few patients refer them to the nose. The symptoms vary from pain and semiannual discharge of pus, mucopus or watery substance, to cough, tracheitis, bronchitis, pain in the region of the stomach and abdominal distention with gas. The bacteriologic findings likewise vary. Commonly pus cells only are found, occasionally staphylococci, rarely pneumococci and seldom isolated groups of streptococci. In one case of succeeding attacks of subacute ethmoiditis, the influenza bacillus is always found. Some have dry throat and in one case accompanying pain with sleepiness.¹ Most of

1. A chiropractic cured his sleepiness by hitting him on the back of the head (!) (neurasthenic).

these patients are relieved by opening the cells and removing at the same time the middle turbinated bone. Occasionally puncturing the anterior cells will give instant relief of pain. Palliative treatment with cocain, epinephrin and antiseptic sprays or washes seldom relieve the symptoms. Although these cases seldom terminate fatally, suffering is often unbearable.

One patient with a history of thick discharge from the nose some years before had now this irritating result, coughing day and night for six weeks. Examination showed a latent sinusitis; but as there was also some burning sensation during micturition, I advised an examination of the urine, in which was found albumin, casts and blood cells. Treatment directed to this relieved all symptoms without operation.

A second case of chronic suppuration involved the antrum also, as well as frontal sinuses, with severe frontal headache. Here the urine was loaded with albumin; although the patient was suffering severely, I sent her home to have her physician treat her first.

A girl, aged 12 years, with orbital abscess, became totally blind in one eye before I saw her. The pus was evacuated, the involved antrum drained and she recovered without operation on the cells. Sight, however, was lost.

In another case, in which the disease involved the frontal sinuses and antrums, the bone was so softened that a sharp spoon easily penetrated to the brain. The brain was bathed in pus to the extent of half its surface. This was of course syphilitic. I have also seen epilepsy of recent origin and asthma both relieved by draining the cells.

In my cases I found chronic empyema more often bilateral than unilateral.

In consultation I have seen but four cases which terminated fatally, besides two private patients, both physicians. One of these, aged 27, with a previous history of suppuration, had an attack of scarlet fever; on the eighth day, while sitting up, he was suddenly attacked with pain. He made his own diagnosis, remembering his previous attack. He died the third day of meningitis.

The second case was a physician, aged 35, run down with hard work. The cells had been drained a year previous to the attack. Pain was mostly in the forehead. The discharge was intermittent up to this time. He was seen by several physicians and surgeons. A diagnosis of meningitis was made. Decompression was done while the patient was unconscious but he died at the end of two weeks. All the fatal cases were meningitis, and the ages ranged from 12 to 35 years.

I have never seen caries in empyema except in syphilis. Twice I have seen epilepsy, and in two cases asthma of recent origin, all relieved by the ethmoid operation, one epileptic permanently. In all my cases I have had only two unilateral and one of them was due to a foreign body which was in the nose for seven or eight years.

THE SURGERY OF THE ETHMOID LABYRINTH

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The ethmoid is in several ways the central point of interest in questions relating to the nasal accessory sinuses. Developmentally the other sinuses, particularly the frontal and maxillary, are distinct outgrowths from the ethmoid. Anatomically the ethmoid, because of its central location, constitutes a key to the other nasal sinuses, including the sphenoid, as well as the frontal and maxillary sinuses. Pathologically the ethmoid labyrinth is more or less involved in almost every inflammatory process involving the other sinuses. And finally, the surgical treatment of inflammatory processes in any of the nasal accessory sinuses includes to a greater or less extent operation on the ethmoid labyrinth. It is evident, therefore, that any one who undertakes the treatment of nasal accessory sinus trouble should first of all be well grounded in the surgical anatomy of the ethmoid and should be familiar with the methods of operating on this structure.

Anatomic variations are peculiarly characteristic of the nasal accessory sinuses, and in none is this more marked than in the case of the ethmoid. There are, however, certain anatomic relations common to all cases. It is these constant relations which it is most important to keep in mind, since it is on these that the surgery of the labyrinth is based.

The first anatomic fact to keep in mind is the openings of the ethmoid cells into the nose. These openings are separated into two series by the plate of the concha media, and are clearly shown in Figures 1 and 2. The first figure, with the middle turbinated body in place,

shows the openings for the posterior ethmoid cells above and posterior to this structure. Inspecting the nose from in front, secretion coming from the posterior ethmoid cells will be seen between the septum and the concha media, that is, in the meatus nasi communis. Figure 2, with the middle turbinated body cut from its attachment, shows the openings from the anterior series of ethmoid cells in the meatus nasi media. Secretion coming from these cells appears, therefore, between the concha media and the outer wall of the nose.

A second important anatomic fact is the relation of the ethmoid to the orbit. This relation is shown in Figure 10. The outer wall of the ethmoid labyrinth is formed by the orbital plate of the ethmoid and to a limited extent by the mesial wall of the maxillary sinus.

A third constant anatomic relation which has an important surgical bearing is the relation between the ethmoid cells and the brain fossa. This relation is best shown in a frontal section, as in Figure 10. The roof of the ethmoid labyrinth is formed by the floor of the anterior brain fossa. The bone forming this wall of the labyrinth is rather firm as compared with the much more fragile orbital wall. It is especially important to keep in mind the relation between the ethmoid cells and the cribriform plate. The bony plate forming the roof of the labyrinth joins the cribriform plate, but at no place do the ethmoid cells come in contact with this plate. The cribriform plate forms the roof of the meatus nasi communis. In order, therefore, to avoid perforating this delicate structure when operating on the ethmoid labyrinth, it is important to keep out of the meatus nasi communis. This is best accomplished by allowing the mesial wall of the labyrinth to stand until the exenteration of the ethmoid cells has been completed, when this wall of the labyrinth can with safety be clipped away.

There are certain anatomic variations to keep in mind when working on the ethmoid labyrinth. One

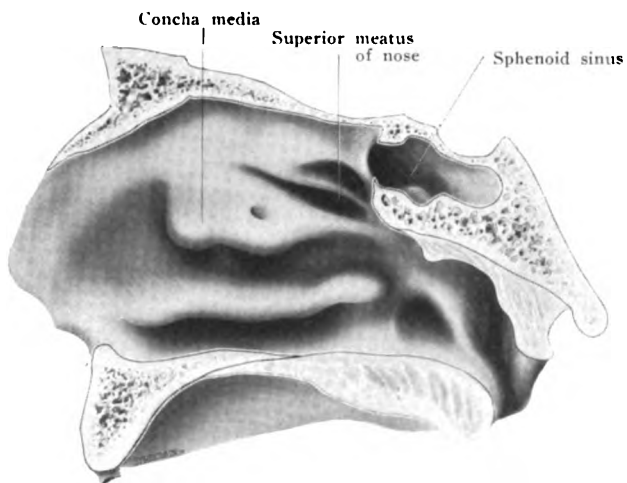


Fig. 1.—Sagittal section, showing lateral wall of nasal cavity.

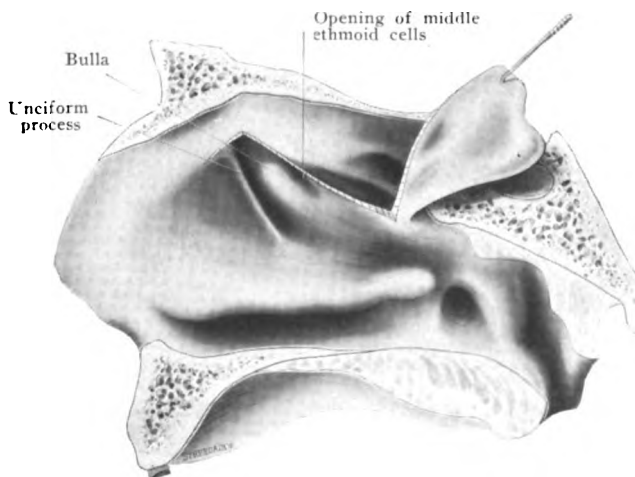


Fig. 2.—Middle turbinal removed, showing structures in middle meatus.

Cell of agger nasi

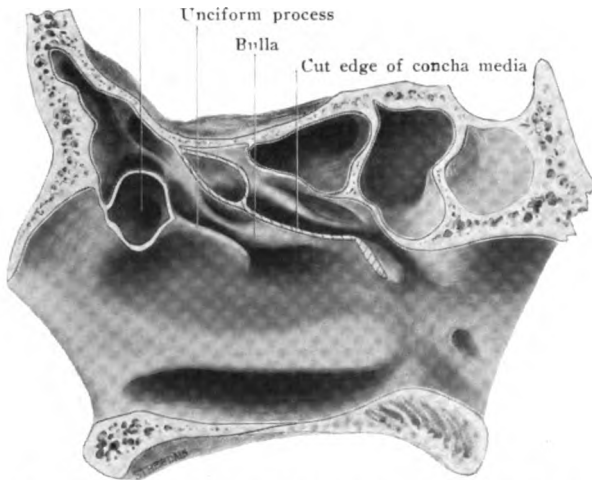


Fig. 3.—Lateral wall of nose; middle turbinal removed and ethmoid cells opened.

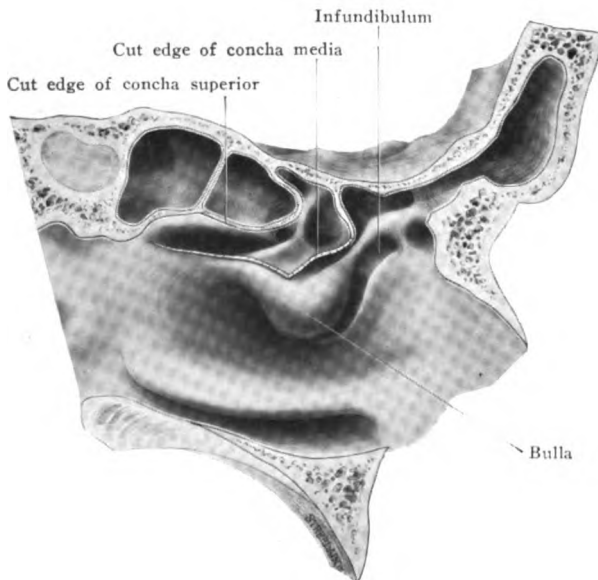


Fig. 4.—Lateral wall of nose; middle turbinal removed and ethmoid cells opened; bulla ethmoidalis large and dependent.

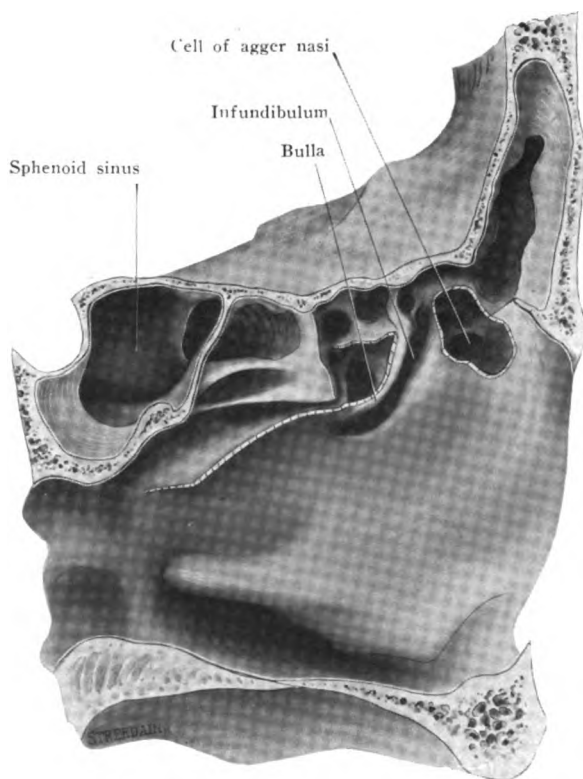


Fig. 5.—Lateral wall of nose; ethmoid cells opened. Cell in agger nasi.



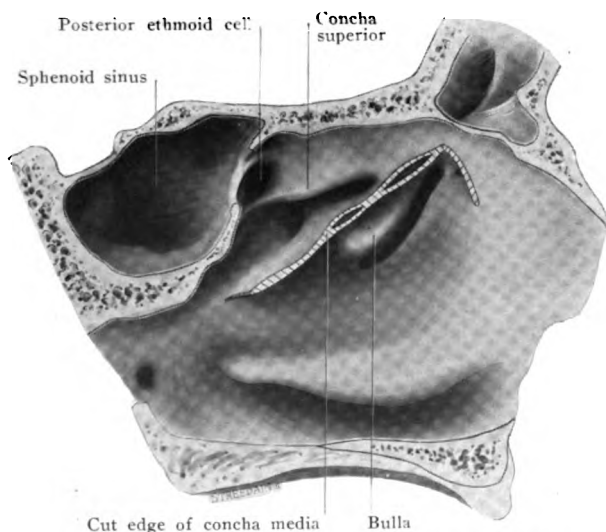


Fig. 6.—Lateral wall of nose; concha media removed.

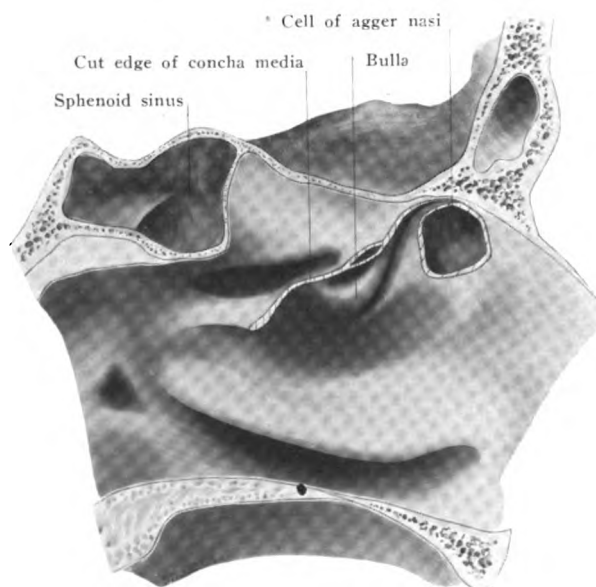


Fig. 7.—Lateral wall of nose; concha media removed. Large cell in agger nasi.



Fig. 8.—Lateral wall of nose; concha media removed. Second step in exenteration of the ethmoid labyrinth, forceps breaking into bulla ethmoidalis.





Fig. 9.—Final step in ethmoid exenteration; removal of anterior ethmoid cells.

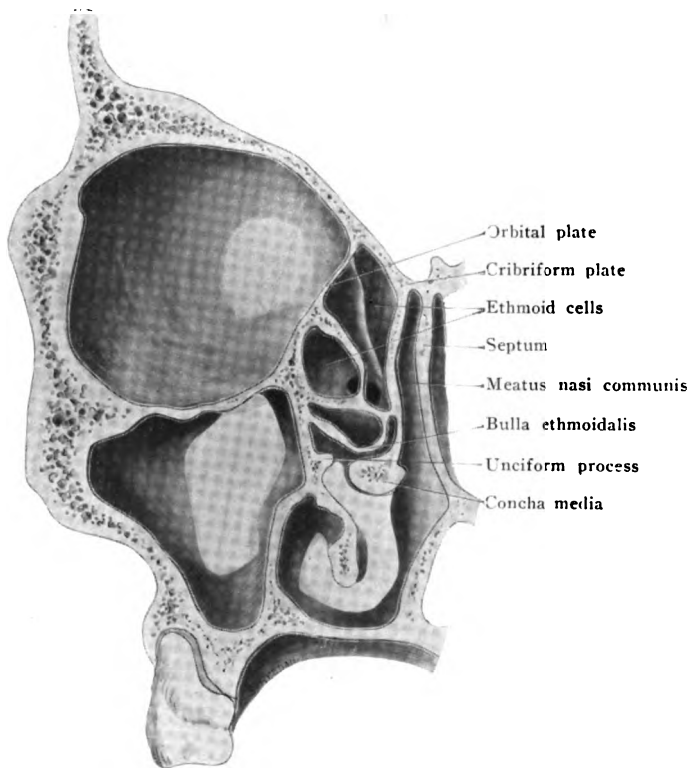


Fig. 10.—Frontal section, showing relations of ethmoid labyrinth to surrounding structures.



variation is the development of ethmoid cells outside the usual confines of the labyrinth. The first of these is the distention of the concha media by an ethmoid cell. This cell occasionally develops to a great size, obstructing the respiration on the affected side. The largest cell of this sort recorded was reported by me. The cell measured 28 mm. long and 25 mm. broad.¹

Another anatomic variation is the development of an ethmoid cell in the unciform process, in the region which we designate as the *agger nasi*. This anatomic variation is not such a frequent occurrence as the cell in the concha media. Like the cell of the concha media, it occasionally takes on a large size. Cells of the *agger nasi* are shown in Figures 3, 5 and 7. The one shown in Figure 3 is unusually large. Other anatomic variations of this sort are the development of ethmoid cells upward into the frontal sinus, laterally over the roof of the orbit, and posteriorly over the sphenoid sinus.

Operations on the ethmoid consist of the removal of a part or the whole of the ethmoid turbinated body, the concha media, and the exenteration of a part or the whole of the ethmoid labyrinth. Only the intranasal operation on the ethmoid will be considered here, for the reason that the external operation on the ethmoid is rarely called for.

The operations on the concha media are undertaken for several quite different conditions. Some have to do with pathologic conditions outside the ethmoid, as disease in the frontal and maxillary sinuses. Others are concerned with disease of the ethmoid itself.

The resection of the concha media, by which the middle meatus is laid open, is often the simplest way to get relief from obstruction causing retention in the frontal or maxillary sinuses. The removal of the concha media is also the preliminary step in the resection of that part of the nasal wall of the maxillary sinus lying in the middle meatus. This is the simplest

1. Shambaugh, G. E.: Bony Cysts of the Middle Turbinated Body, *Ann. Surg.*, 1902.

of all the operations on the maxillary sinus, and is often the operation of choice for the relief of acute or chronic empyema of this sinus. The resection of the concha media is also the preliminary step in securing adequate drainage for acute or chronic empyema of the frontal sinus.

The conditions in the ethmoid itself, for the relief of which the resection of the concha media is undertaken, include cases, where as the result of a narrow nasal chamber, the middle turbinated body is found wedged so tightly between the septum and the outer wall of the nose that with the slightest intranasal reaction the normal ventilation of the anterior ethmoid cells, as well as the frontal, and even the maxillary sinus, is impaired. The symptom resulting from this condition is first of all sensation of pressure or even pain between the eyes. The obstruction often excites attacks of sneezing, which are not infrequently associated with profuse watery nasal discharge. The resection of the concha media is undertaken to relieve nasal obstruction occasionally caused by a bullous enlargement of the concha media itself. This operation is often the first step in the operations for the relief of the symptoms resulting from the pathologic condition known as hypertrophic ethmoiditis. Very often the improved ventilation of the ethmoid labyrinth, accomplished by the resection of the concha media, is all that may be required to bring about a relief of these annoying symptoms and for the cure of the earlier stages of hypertrophic ethmoiditis. The frequency with which the condition of hypertrophic ethmoiditis is found associated with the anatomic condition described above, causing impaired ventilation of the ethmoid, justifies the suspicion that the development of hypertrophic ethmoiditis may sometimes be the result of impaired ventilation of ethmoid cells.

It is evident that the class of cases where the resection of the concha media is indicated includes very often just those cases where, because of anatomic

conditions, the operation is more difficult to carry out. In recent years I have discarded other methods of removing the concha media for the method devised by Andrews, by which, with the use of a specially made knife, the anterior part of the concha is easily cut away from its attachment, permitting the introduction of a snare, when the turbinated body can either be cut off or pulled away from its attachment. By this method I have found it feasible to remove the middle turbinate in the most difficult cases, where, because of the constricted nasal chamber, it was scarcely possible to secure more than a glimpse of the lower edge of this structure.

The exenteration of a part of the ethmoid labyrinth is undertaken chiefly in the effort to secure better drainage for a frontal sinus infection. Here the anterior ethmoid cells are often included in the inflammatory process affecting the frontal sinus. The ethmoid operation serves, therefore, the double purpose of removing the diseased ethmoid cells and of securing better drainage from the frontal sinus. The partial exenteration of the ethmoid cells may also be undertaken in cases of beginning hypertrophic ethmoiditis, or for the relief of symptoms arising from the rather rare condition of mucocele of the ethmoid.

The complete exenteration of the ethmoid labyrinth is undertaken chiefly for the relief of two pathologic conditions: the one is the diffuse hypertrophic ethmoiditis and the other is the chronic purulent ethmoiditis. The latter may be a complication of a preexisting hypertrophic ethmoiditis, and often it is but a part of a pansinusitis involving all of the accessory sinuses on one or on both sides of the nose.

In selecting a method for accomplishing the ethmoid exenteration, two principles should be kept in mind: the first is the safety of the patient, the second, simplicity of technic. For obvious reasons the operation is usually done under a local anesthetic. It is quite important, therefore, that it should be done as quickly

as possible. The method for exenteration of the ethmoid which I shall describe here is the one which seems to me to fill best the requirements of safety, simplicity and rapidity.

The first step in most cases is the removal of the concha media. This is necessary to give the best possible inspection of the field of operation. In exceptional cases where the concha media is small and does not interfere with the inspection of the structures forming the floor of the ethmoid in the middle meatus, the concha media may be left standing, at least until the exenteration of the labyrinth has been completed, when it should, as a rule, be removed, in order to prevent further impairment of drainage, especially through the formation of inflammatory adhesions.

The second step in the operation is accomplished in a very few seconds by using the type of nasal forceps shown in Fig. 8. This instrument has in my hands proved to be the one best suited for such work. It is easily held firmly with the fingers of the right hand while the cutting edges of the blades are readily forced through the fragile cell walls. The force is always directed more horizontally than upward and away from the septum, so as to avoid risk of injuring the cribriform plate. The risk of injuring the orbital plate is not great. The removal of a part of the orbital plate is apparently not any more dangerous than the exposure of the dura in the course of a mastoid operation. The most dependent part of the ethmoid labyrinth is the bulla (Figs. 10, 6, 4). This is broken into first (Fig. 8). In those exceptional cases where the agger nasi is the seat of an ethmoid cell, it will occasionally be advantageous to begin, as Mosher has advised, by breaking into this cell first. After the bulla has been broken into it is the work of but a few seconds to complete the exenteration of the middle and posterior ethmoid cells.

The final step in the operation is the removal of the anterior ethmoid cells. This is done by using

forceps which cut forward (Fig. 9). The median plate of the ethmoid is best left in place until all of the cells have been removed. This serves as a protection against encroachment on the meatus nasi communis, the roof of which is formed by the cribriform plate. In some cases, especially where the nasal passage is contracted, it is best not to attempt to preserve this median plate of the ethmoid but to cut it away as rapidly as the adjoining cells are destroyed.

The use of curets will sometimes be of distinct assistance in accomplishing the exenteration of the ethmoid cells. There are two situations where I have found the curet an assistance. The first is a condition where, because of an unusual firmness of the bony walls, it is found difficult to break into the labyrinth with the forceps. The second indication is to complete the removal of the labyrinth in certain cases, after the work with the forceps has been completed. The type of curet to use is important. This should be a strong, well made curet, without a sharp point. The type used in mastoid work, for example, the Whiting model, serves our purpose here very well. This is the type of curet which Mosher has also adopted for operation on the ethmoid. I have found the Mosher model the best curet for ethmoid work.

As regards after treatment, most of the cases require no special treatment. The operation is done at the hospital, since the shock resulting from work on the ethmoid makes it undesirable for patients to attempt to go home immediately after the operation. Most of the cases require no tampon if the patient remains at the hospital, where directions can be left for the introduction of a tampon in case secondary bleeding requires it. Occasionally one meets with severe bleeding at the time of the operation which may require the immediate introduction of a tampon. This should always be removed not later than the following day.

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THE SURGICAL TREATMENT OF CHRONIC MAXILLARY SINUSITES

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According to Jonathan Wright, Galen was the first to mention the maxillary sinus, but Brengar was the first to describe it. However, the first description of any real value was made by Highmore in 1651 and since then the cavity has borne his name. At the same time he reported a case of suppurative disease of the sinus. Mollinette in 1675 made a crucial incision on the jaw, and with a trephine penetrated the antrum and located an abscess. Meibomius, who died in 1655, invented the operation now known as the Cooper operation. Cooper described his operation in 1717. Jourdain, a Paris dentist, in 1765 reported a method of washing out the antrum through the natural opening. Grooch, an English surgeon, who died in 1780, and John Hunter in his treatise on the human teeth proposed perforating the antrum through its nasal surface. Wright states that in going over the history of the antrum and its diseases one will perceive that all recent procedures have been long anticipated.

The treatment of maxillary sinus diseases was apparently neglected; at least it did not receive the attention it had formerly. It received a new impetus in 1886 when Ziem pointed out that disease of this cavity was not only far from infrequent, but a common occurrence. Since then a number of operative measures have been devised.

The operations for chronic maxillary sinus disease may be divided into three classes: (1) those in which the cavity is attacked only through the mouth, as in

the Cooper and Kuster operations ; (2) those in which the cavity is attacked only through the nose, as in the Krause, Mikulicz, Canfield and Skillern operations ; and (3) those in which the antrum is attacked through the oral and nasal cavities, as in the Caldwell-Luc and Denker operations.

The Cooper operation is employed only when a carious tooth or root is the etiologic factor ; usually the second bicuspid or the first and the second molar are removed, the opening enlarged and smoothed with a drill, and drainage established by means of gauze or a specially devised tube or obturator, which is worn by the patient until the cavity is healed. The chief disadvantage is that if there are any marked pathologic changes in the sinus the process will not get well.

The Kuster-Desault operation consists of a free opening of the antrum through the canine fossa and curetting the walls of the cavity. This operation has been practically abandoned.

Of the intranasal operations, the simplest is the Krause-Mikulicz, which consists in the removal of the anterior third of the lower turbinate. The antrum is then punctured with a large trochar and thoroughly irrigated. The opening is enlarged by means of a punch forceps and packed with gauze. This packing is removed at the end of twenty-four hours. The patient can be taught to irrigate the cavity until healing has been secured. The advantage is its simplicity. The disadvantage is that if any marked pathologic changes are present, it will not suffice.

The Canfield operation, which is a modification of the Denker operation, to be described later, consists of the intranasal, submucous resection of the naso-antral wall under local anesthesia. A 1 per cent. solution of cocain is injected in front of the inferior turbinate ; the needle is directed so that the solution is carried under the periosteum in the canine fossa. The lower turbinate and lateral wall of the nose are cocainized in the usual way. An incision is then made from the

middle of the anterior attachment of the inferior turbinate down to the floor of the nose. This incision is made through all the tissues down to the bone. A small elevator is introduced and the periosteum elevated from the crista pyramidalis externally toward the canine fossa, and internally toward the nose, including the mucous membrane covering the inferior turbinate and the lateral wall of the inferior meatus. The bony structure of the inferior turbinate is removed, and the antrum may then be opened by means of a chisel, trephine or rongeur bone forceps. Enough of the bone in the canine fossa, as well as the bony wall of the inferior meatus as far back as the posterior wall of the antrum, is resected. A large-sized ear speculum is introduced and the interior of the antrum is inspected. A flap of mucous membrane is turned into the antrum from the nose and the cavity is packed with gauze, which is allowed to remain from twenty-four to forty-eight hours. The after-treatment consists of touching subsequent granulation tissue with caustics. Healing occurs in from ten days to three months. The advantages of the operation are that there is very little disturbance following the operation; the sinus can always be inspected, and the process of healing noted; drainage is at the lowest possible point. The objection to the operation is the removal of the inferior turbinate.

Skullern has modified the Canfield operation in that, after cocaineization, a perpendicular incision is made slightly in front of and above the anterior end of the inferior turbinate extending well into the floor of the nose. The incision should sever all the tissues down to the bone. A second incision is made directly back of this, meeting the first one above and below, so as to excise a spindle-shaped piece of mucous membrane. The periosteum is then raised from the crista both externally toward the canine fossa and internally toward the inferior turbinate until a sufficient portion of the bone is exposed. The antrum is now opened

with a chisel and bone forceps by removing the crista pyriformis. The opening is enlarged by means of a trephine and frontal sinus rasp to any desired size. The cavity is then irrigated and packed with gauze saturated with a cocain-adrenalin solution and allowed to remain five minutes, after which it is removed and the interior of the cavity inspected through a hard rubber ear speculum. The nasopharyngoscope is used for inspecting the roof and other parts of the cavity which cannot be seen by direct inspection. By means of suitable curets all portions of diseased mucosa can be removed. After completing the operation the cavity is packed with iodoform tape. This is removed in from forty-eight to seventy-two hours. After its removal the cavity is cleansed by irrigation and lightly repacked with iodoform gauze. The treatments are continued every second day for from ten days to two weeks, when the packing is permanently discontinued. The irrigations are continued at intervals of about four weeks. In ordinary cases the patient is discharged as cured at the end of that time. In cases of long standing and in which large areas of mucous membrane are removed Skillern, after thoroughly cleansing and drying the cavity, injects into it solutions of nitrate of silver varying in strength from 25 to 75 per cent. At times the opening has a tendency to close. This can be prevented by curetting the edges and applying a caustic. Skillern claims the following advantages for his operation: (1) the sinus can always be inspected; (2) the drainage is at the lowest and most accessible point, reached through the nose; (3) local applications directly under vision can be made to diseased areas which have proved resistant to treatment; (4) the inferior turbinate is not only preserved in its entirety, but it remains uninjured; (5) the operation is practically painless if the anesthetization is properly carried out; and (6) the period of healing is considerably shortened.

Of the combined oral and nasal operations, the Caldwell-Luc was for a long time considered the most radical procedure and was employed only in the most obstinate cases. The operation consists of making a large opening in the anterior wall of the sinus through the canine fossa, giving free access to the interior antrum. After all diseased mucous membrane has been removed, a large opening is made in the antro-nasal wall beneath the inferior turbinate, a portion of the inferior turbinate is also removed so as to procure drainage into the nose. A flap is made from the mucous membrane of the lateral wall of the nose and turned into the antrum. The cavity is packed with gauze through the nose. The oral wound is allowed to close primarily, some operators closing it with sutures; but this, in our experience, has been found unnecessary. The operation is usually done under general anesthesia. The employment of the intratracheal method of general anesthesia obviates the necessity of packing the posterior nares, as was formerly done, and in a great measure overcomes the objections to the employment of a general anesthetic in intranasal work. The operation can be done under local anesthesia when a general anesthetic is contraindicated.

In 1905 Denker brought forth an operation which is similar to the Caldwell-Luc, but much more radical. Denker removes the anterior antral wall, the lower portion of the angle formed by the junction of the anterior and nasal walls, making a common opening between the nose and the sinus anteriorly. A large part of the inferior turbinate is removed. Denker has since modified his operation, in that he leaves the inferior turbinate intact. In this operation the after-treatment is carried out in the same manner as in the Caldwell-Luc. The chief advantage of the Denker operation is that practically all of the sinus mucosa is under direct inspection. The only exception is the anterior superior angle. This may be seen easily with a postnasal mirror. It has the advantage of being more

extensive and less difficult than the Caldwell-Luc, and in the majority of cases the convalescence is more rapid. The objections to the operation are that the nerve supply of the front teeth is interfered with and at times the tear duct is injured. Skillern mentions three cases in which stenosis of the duct followed. He also mentions three cases of osteomyelitis of the superior maxilla, with two deaths.

The Jansen operation I believe to be too radical and am of the opinion that equally good results can be obtained by simpler procedures.

The necessary specifications of a good method are a large opening or openings of sufficient size to permit thorough inspection and good drainage with the least disturbance of nasal function. This, I believe, can be accomplished by a modified Canfield, such as the Skillern, or a Denker, in which the inferior turbinate is left intact.

A most important consideration in estimating whether a radical operation must be resorted to is that of the primary or secondary character of the maxillary sinus involvement. The claim of Jansen that if one sinus is affected all are is not tenable. When, however, the antrum is a reservoir for ethmoidal or frontal sinus suppuration, or when its involvement is secondary to such suppuration and the trouble is not of too long standing, it is frequently necessary only to cure the primary trouble and then, at most, to handle the maxillary sinus by lavage. The causes of failure of the radical maxillary operations are frequently due to the overlooking of a decayed tooth or necrotic bone in the alveolar process as well as pathologic conditions in the nose and other sinuses.

The value of the Roentgen ray in discovering pathologic conditions of the teeth and maxillary sinus cannot be overestimated. We must also bear in mind the general condition of the patient. Here, as elsewhere, syphilis and tuberculosis must not be overlooked.

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THE SPHENOID SINUS

A REVIEW OF THE PAST WITH SUGGESTIONS FOR
THE FUTURE

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The study of the sphenoid sinus is most fascinating and presents many opportunities. Located as it is on either side of the midline of the under side of the head, often extending far to the opposite side, its size and shape vary with respect to its fellow more than any bilateral organ or cavity of the body. This appears even more remarkable when its relations are considered to such important and fairly constantly placed structures as the cranial cavity, cavernous sinus, internal carotid artery, optic nerve, optic chiasm and pituitary body. The bony coverings of the sinus and the bony outline of other portions of the sphenoid and the adjacent bones give no indication of the extent or shape of the sinus. Even the position of the nasal opening, as I have shown, is subject to wide variation, while the septum between the two sinuses is conspicuously inconstant in form, size and position.

The operative work done so successfully nowadays in spite of the distance from the anterior nares adds to the interest which we feel for the cavity, while the danger, though slight, of operating so close to such vital structures as the cavernous sinus, internal carotid arteries and higher brain centers gives it a zest to which only the timid will not respond.

Our understanding of the sphenoid has been of recent growth, but it has developed by leaps and bounds. The remote past contributed but little to this

knowledge. The ancients as well as the writers of the middle ages understood the sphenoid sinuses, like the other accessory sinuses of the nose, as being mere accidental cavities with the function of relieving the head of the weight which solid bone would entail. They were, however, considered of great importance by reason of their ability to drain the brain of its humors, or of their disposition to remove pus and other fluids from the brain cavity. Even Hippocrates suggested that pus in the nose came in part from the sphenoid sinus, although he did not know the precise pathway it took in its journey.

Schneider's observations, which excluded the nose from any communication with the cranial cavity in life, brought an end to the supposed brain-purging function of the nose and gave rise to speculation as to the purpose of the individual sinuses.

The Sphenoid sinus took but little part in the hypotheses that were advanced, either from the fact that little was known as to its extent and relation to the nose, or because no explanation, reasonable or unreasonable, could be given for its existence. It is quite obvious, therefore, why so little attention was paid to it for all these years and why, for instance, Hyrtl in 1882 stated that the sphenoid sinus was entirely beyond the range of manual and instrumental attack.

But the wonderful work of Zuckerkandl published the same year was destined to change this entire conception of the subject, for he gave the study of the normal and pathologic anatomy of the accessory sinuses of the nose an impetus which it retains even to this day. His findings as to the sphenoid are particularly of value in that he established the usual relation of the sinus to the optic nerve. Very little has been added to this work. We may mention Onodi, who demonstrated the relation of the sphenoid and posterior ethmoidal cells, the writer who showed the variation in size and shape and the vulnerability of the optic nerve when the sinus

opening is high in the upper third of the anterior wall; and Sluder, who made extensive studies on the relation of the sinus to the various cranial nerves.

The investigations of Zuckerkandl were soon followed by determined efforts to utilize them for therapeutic purposes, although it was some time before effective measures were adopted. The first article in which the sphenoid sinus is mentioned in the caption appeared in 1886, by Berger and Tyrman.¹ Even then they supposed that the suppuration was always due to syphilis, scrofula or traumatism.

Schaeffer, who was the first to open the sphenoid, in 1885 contributed a great deal to the development of the knowledge of this cavity, while Berger and Tyrman, Rolland, Heryng, Rualt, Quenu, Clark, Cozzolino, and others wrote more or less extensively during the first ten years following the publication of Zuckerkandl's monograph. Schaeffer and his followers endeavored to secure drainage of the sinus by simply enlarging the natural opening, although Schaeffer himself attempted to extend the enlargement to the floor of the cavity. Killian in 1900 called attention to the frequency of the coincident involvement of the last posterior ethmoid cell and the possibility of securing a larger opening by operating through the pars ethmoidalis. However, it was Hajek who demonstrated by his painstaking investigation and observations that the best results could be obtained only by a resection of both the pars ethmoidalis and the pars nasalis of the anterior wall of the sinus. Since these publications little has been done except to confirm them and to establish a somewhat more definite indication for the operation.

The operative attack of the hypophysis by way of the sphenoid sinus, which has been developed during the past few years, has been accepted as the most satisfactory plan, particularly when removal of the bony wall alone is required. The technic is easy for experi-

1. Berger and Tyrman: *Centralbl. f. Laryngol.*, 1886.

enced operators on the nose and the results are sufficiently good to justify the interest that has been manifested in it. The development of roentgenographic studies in connection with the pituitary question has been satisfactory, though it must be admitted that roentgenography has so far been of little value in the diagnosis of sphenoid empyema.

We have thus seen that the entire progressive part of our knowledge of the sphenoid sinus has occurred within the past thirty-five years, while its surgery was practically an unknown quantity thirty years ago.

We are very apt to be filled with pride when we contemplate the development of a new line of work which has achieved as much as that of the sphenoid in such a short time, particularly in anatomy, diagnosis and surgery. In order that we may not feel too well satisfied or despair that everything has already been discovered, it may not be amiss to view some of the problems which remain unsolved in connection with this subject.

1. Among the very first that should attract our attention is the cause of the excavation of the sphenoid body, resulting in the formation of these sinuses, with such a variety in shape and size. The pressure of the air in the nose in breathing might appear to be the explanation, especially as the changes take place during the air-breathing stage of the individual. So far experiments with this in view have added nothing toward its solution; there is still plenty of opportunity in this direction.

2. Associated with this question is that of the relation of the posterior ethmoid cells to the sphenoid. Why does the last posterior ethmoid cell sometimes project itself into the sphenoid and replace the corresponding sphenoid sinus? I have shown that this occurred twice in the thirty sphenoid sinuses studied by me, and that in those instances the optic nerve ran for a considerable distance along the external wall of

this ethmoid cell instead of having only the slightest relation at the postero-external angle of the cell. Is my surmise correct that under the former circumstances the optic nerve is more vulnerable to ethmoid infections?

3. What bearing has the sphenoid sinus on the cranial nerves in its neighborhood? Are they susceptible to the influence of purulent infections of the sinus?

4. The physiology of the sphenoid sinus is still almost an unknown quantity. Beyond its value as a means of decreasing the weight of the head without reducing the bone surface area, we have little to say, and this was held nearly 3,000 years ago. By the development of the sphenoid sinus from the nasal cavity there is a consequent increase in the respiratory mucous membrane. When shall we be able to answer the question as to what may be the purpose of this great extension of the nasal mucosa?

5. As to etiology, we are still much in the dark. We know that suppuration of the sphenoid may follow certain of the infectious diseases; we know it frequently follows acute coryza and suppuration in other sinuses; we know many varieties of pathogenic bacteria find their way into the cavity, but we do not know what selective agent accounts for the attack of the sinus at the specified time. We do not know why the sinus should escape infection when every necessary condition is present so far as our knowledge goes; at any rate the opportunity is abundant, the attack rare. No one needs, therefore, complain that etiologic problems are wanting.

6. The symptomatology of sphenoid sinus suppuration presents a wide range. In many cases practically no subjective signs whatever are present; in others the suffering is most acute. While this may be accounted for in part by the variation of the drainage, the explanation does not suffice for cases in which the symptoms fail to agree with the facility of drainage. We hear of

an attack of blindness ascribed to sphenoid suppuration and relieved by appropriate treatment addressed to the sphenoid sinus, and we forthwith look to it as an explanation of eye symptoms of any character, provided they have no intra-ocular cause. We read of a case of acute mania due to suppuration of this cavity and we rush to tap the sinus in all cases of mania, whether there is suppuration or not.

What we need is to have someone determine the symptom basis so that a clearer line may be drawn between the symptoms due to the sphenoid and those which have some other origin.

7. Our best agents for diagnosis are cocain, the Killian speculum and the Holmes nasopharyngoscope. Roentgenography offers but little ; we can make out the lateral bony boundaries of the sinus fairly well, particularly when we take advantage of stereoscopy. We can see it in the outline in some measure by an anterior view picture, but on account of its distance from the plate, we cannot determine the presence of pus, as in the case of frontal and maxillary sinuses. Who will find the solution for this problem?

8. We have not achieved the highest point in the surgery of the sphenoid. Notwithstanding the ease with which we resect the anterior wall, we still must submit to failures, even though many operations are followed by marvelous results. The suppuration continues in spite of our most earnest efforts. On the other hand, patients treated expectantly sometimes recover. Success, we may say, now depends largely on the judgment of the operator. Will not some earnest investigator place this on a basis more independent of the mere judgment of the operator than now obtains?

9. Who will so classify the chain of nervous symptoms, headache, etc., that sphenoid operations for their relief may be rational and not experimental? Truly there is a large field here for study and investigation.

10. We cannot fully account for postoperative accidents and results by what we know, nor are they always due to operative inefficiency. We need a great deal more light in this regard.

On the whole, it is manifest that we have not reached the utmost limits of knowledge by what we have accomplished in the study of sphenoid sinus. For that reason I have endeavored to show, not how little we know, but how much we are to know.

SPHENOID SINUS

PRESENT DAY VALUE OF SURGICAL PROCEDURE

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The recognized procedures of today of operating on the sphenoid sinus can be divided into the intranasal and extranasal. As the latter (extranasal) is never used except when other sinuses are coaffected, we will consider more particularly those operations which are performed through the nose. By this method the anterior sphenoidal wall is invariably attacked, although the ways and means are often divergent, as, for example, Schaffer¹ used a sharp curet, Spiess² penetrates into the sinus an electric trephine, Grünwald³ a conchotome, Andrews⁴ a curved knife, Grayson⁵ a hand-burr, etc., with or without the removal of the middle turbinate; but it was not until Hajek⁶ published his paper in 1904 that the operation assumed a definite form in progressive steps.

Briefly, his method is as follows: The posterior half of the middle turbinate is removed by means of the scissors and snare (Fig. 1), the posterior ethmoid cells (superior turbinate) broken down with a hook

1. Schaffer: Ueber acute und chronische Erkrankungen der Keilbeinhöhle, Deutsch. med. Wchnschr., 1892, p. 1062.

2. Spiess: Zur Chirurgie der Sinus sphenoidalis, Arch. f. Laryng., 1897, vii, 145.

3. Grünwald: Die Lehre der Naseneiterungen, 1896.

4. Andrews knives, Müller's Instrument Catalogue.

5. Grayson: The Exploratory Opening of the Sphenoid Sinus, Laryngoscope, 1915, p. 65.

6. Hajek: Zur Diagnose und intranasalen chirurgischen Behandlung der Eiterungen der Keilbeinhöhle, Arch. f. Laryng., 1904, xvi, 105.

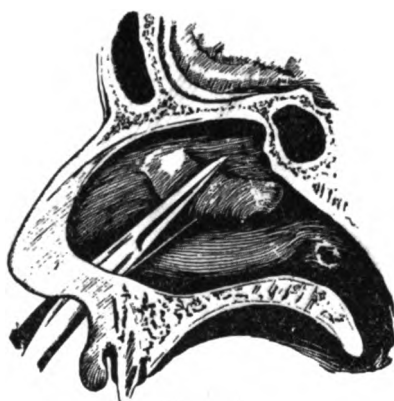


Figure 1.

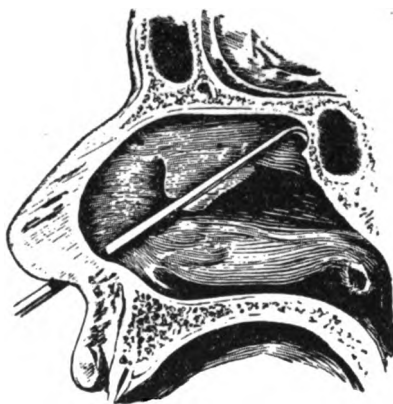


Figure 2.

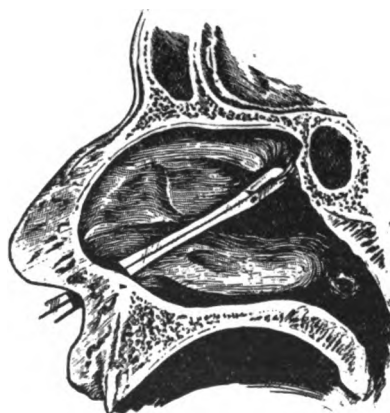


Figure 3.

and removed piecemeal, thus baring the anterior sphenoidal wall (Figs. 2 and 3). This ostium of the anterior wall is removed in its entirety with his heavy bone forceps especially designed for this work (Fig. 4). This method, modified as occasion may demand, is one in general use at the present time.

As this is also the most radical intranasal operation on the sphenoid that we have, the modifications consist in the preservation of the middle and superior turbinate and in the size of the opening made in the anterior sphenoidal wall. We can divide the intranasal operation into the conservative and radical, the former conserving the middle turbinate and all or most of the superior turbinate with more or less enlargement of the natural ostium, and the latter sacrificing these structures with the removal of as much of the anterior sphenoidal wall as possible. In the former the nasal structures are almost undisturbed; in the latter the posterior half of the internal nares is practically exenterated.

INDICATIONS

As the conservative method may to all intents and purposes be considered but a step in the radical, one is justified in all doubtful cases in giving the patient the benefit of the doubt. Thus, when symptoms point to some disturbance in the sphenoid region which demand surgical intervention in the form of aeration and drainage, it is unquestionably poor judgment to open up the sphenoid in its entirety when the judicious enlargement of the sphenoid ostium with the Faraci forceps will suffice to bring about a cure. As a matter of fact, the positive indications for the radical operation are so few that they can be enumerated as follows:

1. In the classical form of chronic sphenoid sinusitis with typical pain, profuse discharge and occasional symptoms of retention where one has reason to believe permanent pathologic changes have taken place in the mucosa.

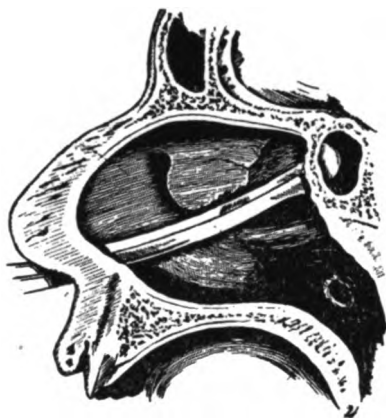


Figure 4.



Figure 5.

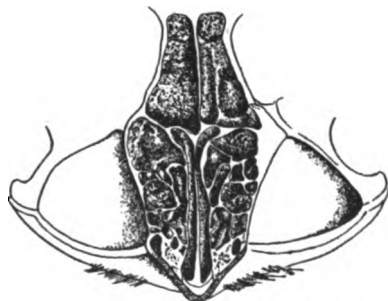


Figure 6.

2. When orbital or cerebral complications threaten or have occurred.

3. Where the conservative method has been tried and found ineffective in bringing about a cure.

4. In mucocele or pyocele of the sinus of long standing.

While these may represent the classical indications, nevertheless there is one factor that must invariably be reckoned with which will greatly influence our form of procedure, i. e., the anatomic configuration of the posterior ethmoid and sphenoidal regions. It will be remembered that the anterior sphenoidal wall is composed of two portions, the nasal and the ethmoidal (Fig. 5). The nasal or free portion represents that part lying free in the nose between the septum and the superior turbinate and contains the spheno-ethmoidal recess (Fig. 6). The ethmoid portion lies behind the last of the posterior ethmoidal cells, representing a ratio of about 3 to 5, the nasal portion being the smaller. This ratio is subject to great variation, the nasal or free portion often presenting but a mere slit, particularly after inflammatory changes have taken place. Given, then, that such circumstances obtained, it would practically be impossible to perform the conservative operation (simple enlargement of the ostium) even though it was clearly indicated by the symptoms present. On the other hand, with an excessively wide *pars nasalis*, the middle turbinate being inrolled against the lateral nasal wall, thus bringing the anterior sphenoidal wall into clear view by anterior rhinoscopy, an extensive operation on the sphenoid can readily be made without in any way injuring the middle or superior turbinate, not to mention the posterior ethmoid cells.

It will thus be seen that the disposition of the structures lying in front of the anterior sphenoidal wall will guide us largely as to the form of operation that will be necessary. A sufficient portion of these struc-

tures must either be removed or pressed to one side to enable one to have free access, both visual and workable, to the anterior wall.

VALUE OF PRESENT DAY METHODS

Before discussing the methods now at our disposal, we must consider the various forms that one is liable to meet in diseased conditions of the sphenoid.

Acute Inflammation.—I doubt if one is ever called on to treat acute sphenoiditis per se, that is, without the rest of the nasal mucosa being involved. It is, of course, possible for general acute infection of the schneiderian membrane to undergo resolution, leaving a focus of inflammation in the sphenoid sinus; but under these circumstances the disease is more or less subacute. The nearest we come to a genuine acute purulent sphenoidal empyema is the acute exacerbation of a chronic sinusitis, particularly when stagnation of the secretion occurs. As this takes on the characteristics of a pyocele, it will be dealt with later.

Catarrhal Inflammations.—This condition is one of the commonest and least recognized of all the diseases which involve the accessory sinuses. Here few of the classical symptoms are observed; but rather the persistent pharyngitis sicca, postnasal discharge, fulness and dryness in the nasopharynx, hawking and rasping in the morning, point to a diseased condition in the posterior part of the nose. Casselberry⁷ has well described this form of affection. Rarely does it become frankly purulent or show marked exacerbations, but tends to continue in about the same degree of inflammation. Simple enlargement of the natural ostium in order to further aeration and drainage will usually suffice to bring about a complete cure. Irrigation is unnecessary, as the mucosa is but slightly affected and will throw off the infection when aided by

7. Casselberry: Attenuated Types of Suppurative Sphenoiditis in Relation to So-Called Postnasal Catarrh, etc., Jour. Ophth. and Oto-Laryng., 1913, p. 210.

ventilation. The value of the conservative operation in this form of disease is unquestioned, and should deserve wider appreciation than it now receives.

Chronic Purulent Inflammation.—In this form the mucosa is infected in local areas, some portions being more or less healthy. The characteristics of this type are remittent. Exacerbations occur in which the symptoms become pronounced, the discharge is profuse, typical headaches appear, etc. During the quiescent stage the symptoms abate, but there is always a certain amount of postnasal discharge, dull headache and a marked tendency to "catch cold." In fact, the

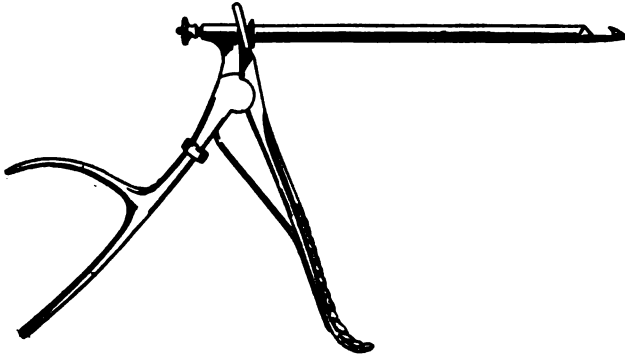


Figure 7.

patient must always exercise the greatest care against excesses of every sort, particularly eating heavy food at night, alcohol, tobacco and mental stress or strain.

The conservative operation here also offers great possibilities. The installation of a good sized opening in the anterior wall without disturbing the middle or superior turbinate will often furnish the desired result. The Faraci bone cutting forceps (Fig. 7) are ideal for this purpose. After the ostium is found by means of the probe and long Killian speculum, it is a simple matter to insert the end of this slender instrument and bite away as much of the anterior wall as desired, at least enough to warrant thorough ventilation and the

best of drainage (Fig. 8). Of course, if anatomic formations prevent the carrying out of this procedure, removal of the impeding structures to such an extent that this purpose may be accomplished is necessary and naturally indicated. Even if this is carried out during an acute exacerbation, its value is at once manifest, for the symptoms promptly subside without further treatment and gradually become less and less apparent, until they disappear entirely together with the patient's susceptibility to take cold or to the excesses which previously had been denied him.

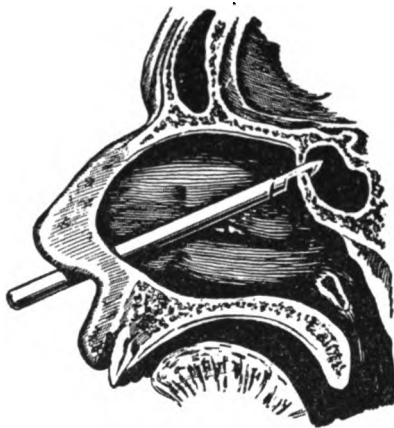


Figure 8.

Chronic Purulent Inflammation with Permanent Pathologic Changes in the Mucosa and Underlying Bone.—This is the typical sphenoidal empyema of the textbooks, and one which is much more seldom met with than either of the two preceding. It is, of course, but an advanced type of these; but when it once occurs, the symptoms admit of no doubt as to the condition present. All the classical symptoms appear and are marked. The radical intranasal operation was devised to meet this condition. As the posterior ethmoid cells are usually involved, their removal serves as a double purpose, to take away the infected cells as well as to

gain room in order to open the sinus in its widest extent. The rationale of this method is to eradicate as far as possible all diseased tissue with complete ventilation of the operated area.

Mucocele.—Pent in collections of mucoid material within the sphenoid sinus are more or less rare, although they have been reported by Rhese,⁸ Benjamins⁹ and others. Obviously here the radical operation is indicated, as the mucosa has been converted into the lining membrane of the sac and will probably never return to its original form. It is, moreover, a well known fact that unless a large portion of the wall is resected, the mucocele tends to reform; at any rate, the sac wall continues to secrete for months. Mucoceles in themselves are rarely dangerous except from pressure, as they tend to assume enormous proportions, causing the osseous walls of the sinus to fairly melt away under their slow but steady pressure. The radical operation will at least put a stop to its subsequent growth and rob it of its dangers, although it is doubtful if the parts ever again assume their normal condition. A catarrhal discharge usually follows, and continues in greater or lesser intensity ad infinitum.

Pyocèle. Closed Empyema.—A collection of pent up pus in a sinus results either from the drainage passages becoming suddenly closed during an attack of empyema or from a mucocele becoming infected (rare). In either case it is necessary to perform a radical operation as soon as possible after the diagnosis is made. Its value in this particular incident will largely be determined by the severity of the infection and the length of time which has elapsed between the onset of the symptoms and the surgical intervention. The earlier the intervention the greater the possibilities of success. However, no case can be considered hope-

8. Rhese: Ueber Keilbeinhöhlenmukozele, Ztschr. f. Ohrenh., 1911-1912, lxiv, 169.

9. Benjamins: Mucocele des Sinus sphenoidalis, Arch. f. Laryngol., 1911, xxiv, 353.

less unless some grave complication, such as purulent meningitis, cavernous sinus thrombosis or brain abscess, supervenes.

INDIVIDUAL METHODS AND THEIR VALUES

Means Employed to Primarily Open the Sphenoid.—

The Curet: This instrument, first utilized by Schaffer,¹ is the method now in use by Killian,¹⁰ Hinkel,¹¹ Mosher,¹² Coakley,¹³ Curtis¹⁴ and many others, and usually involves a very simple technic. After the anterior wall of the sphenoid is brought into view (either by removing a portion of the middle turbinate or in favorable cases by merely infracting that structure against the lateral wall of the nose), the ostium of the sphenoid is sought or, failing to find it, the anterior wall is broken in at its thinnest part or the point of least resistance to the instrument. This is always in the neighborhood of the ostium and high up on the wall. After an opening has been installed and the proper orientation obtained by means of the probe, the break is enlarged by suitable forceps to the desired size. Killian and Mosher vary this by preserving the middle turbinate and excavating, so to speak, the anterior and posterior ethmoid cells until the anterior sphenoidal wall is reached. It is then opened by pressing it in with the beak of the instrument. The comparison of value of these methods depends on the anatomic configuration of the particular case at hand. If the middle turbinate is rolled in close to the lateral nasal wall, thereby presenting a large nasal portion of the anterior wall of the sphenoid so that the ostium is more or less convenient to the end of the probe, there is no question that the direct method or that one which leaves the ethmoid cells intact is the one to be pre-

10. Killian: Ueber die Therapie der Entzündungen der Siebleinzellen und der Keilbeinhöhle, Verhandl. d. deutsch. otol. Gesellsch., 1900.

11. Hinkel: Symptoms and Treatment of Sphenoidal Sinusitis, Tr. Am. Laryngol. Assn., 1902, p. 93.

12. Mosher: The Applied Anatomy and the Intranasal Surgery of the Ethmoidal Labyrinth, Tr. Am. Laryngol. Assn., 1912, p. 25.

13. Coakley: Diseases of the Nose and Throat.

14. Curtis: Modern Methods of Accessory Sinus Treatment, Laryngoscope, May, 1905.

ferred. Even if the ostium is found without being under direct control of the eye, it is perhaps better to attempt to open it, using the probe as a guide, for once being opened it is comparatively easy to enlarge the break until a portion of it is plainly visible. The nasopharyngoscope may be of great value in determining the precise location of the ostium. The great advantage of this method is that the ostium is used as a landmark, i. e., a point of entrance.

In the indirect method (through the ethmoid cells), the middle turbinate is used as a guide until the posterior cells are encountered. It has the advantage that it strikes the thinnest portion of the front wall of the sphenoid (pars ethmoiditis) and permits a much larger opening than the previous method through the spheno-ethmoidal fissure. It is of particular value where the posterior portion of the nasal septum is deflected toward the diseased side or where the middle turbinate is crowded against the septum. Its chief disadvantages are that the sphenoid ostium cannot be well utilized as a point of orientation and that even in skilled hands it is not entirely without danger,¹⁵ certainly much more so than the inside method.

The Sharp Hook: This instrument originated with Hajek,¹⁶ and has found many advocates (Tilley,¹⁷ Onodi,¹⁸ Logan Turner, Boenninghaus¹⁹ and others). The instrument, being long and slender, permits its introduction through a very narrow olfactory fissure until the sphenoid wall is reached. A few well directed scrapes open up the sinus. This instrument is of great value, particularly where judiciously applied, as it is always working away from the points of danger. The only possibility is a sudden breaking in with injury to the lateral sinus wall and the dangerous or even fatal

15. Mosher: Personal communication (not, however, in Mosher's hands).

16. Hajek: *Nebenhöhlen der Nase*, 1898.

17. Tilley: *The Symptoms, Diagnosis and Treatment of Chronic Suppuration in the Sphenoid Sinus*, *Brit. Med. Jour.*, 1905, ii, 1198.

18. Onodi and Rosenberg: *Die Behandlung der Krankheiten der Nase*, 1906, p. 356.

19. Boenninghaus: *Handbuch der speziellen Chirurgie des Ohres*, 1913, iii, 209.

hemorrhage that will surely follow.²⁰ On this account the instrument should not be used blindly, but the ostium sought for and the wall opened in its immediate neighborhood. If, however, the ostium has been found, the need for the hook is at once superseded by the much safer curet. The one eventuality where the hook has served me to good purpose was when the landmarks had become obliterated by blood and torn tissue and where it was necessary to proceed very slowly, as much finer work can be done with its sharp point. The various cells were cautiously opened until at last the sphenoid was reached and the sinus entered through the thin plate which separates it from the posterior ethmoid cell (*pars ethmoiditis*). When used under these circumstances, the instrument possesses a decided value of its own.

The Curved Knife: Andrews uses this instrument, which to all intents and purposes is a sharp hook with rounded end and is manipulated as is the Hajek hook.

Electric Trephine: Ingals,²¹ Spiess,²² Stacke,²³ Stoeckel²⁴ and Halle²⁵ have at one time or another advocated this means of penetrating into the sphenoid. At first glance this would seem to be an ideal method; but taking all things into consideration, it had best be left in the hands of the few that have become skilled in its use. Ingals and Spiess penetrated the middle turbinate, but I presume that they have now abandoned this route. Halle has perhaps perfected the method to the highest state of efficiency, having previously made a crossed incision through the mucoperiosteum of the anterior wall and resected back the

20. Emerson: Report of a Fatal Operative Case, Showing Developmental Absence of the Outer Sphenoidal Wall and in Its Place a Large Vein Communicating Directly with the Cavernous Sinus, *Laryngoscope*, 1909, p. 43.

21. Ingals: Discussion, *Tr. Am. Laryngol. Assn.*, 1905, p. 91.

22. Spiess: Zur Chirurgie des Sinus sphenoidalis, *Arch. f. Laryngol.*, 1897, vii, 145.

23. Stacke: Ueber die Verwendbarkeit des Elektromotors bei Operationen, *Arch. f. Ohrenh.*, 1897.

24. Stoeckel: Die Breite endo-nasale Eröffnung der Keilbeinhöhle mit der Fraise, *Arch. f. Laryngol.*, 1905, xvii, 496.

25. Halle: Die Intranasalen Operationen bei eitrigen Erkrankungen der Nebenhöhlen der Nase, *Arch. f. Laryngol.*, 1914, p. 105.

four flaps, thus exposing the bare wall to his burr. The main disadvantages would seem to be the manual control of the instrument, for even with the steadiest hands a slip is liable to occur, and it only means a very little slip with a rapidly revolving cutting instrument to cause serious or even fatal injuries.

The Chisel: Zarnico²⁶ and Gmeinder²⁷ have constructed long thin guarded chisels to crack an opening into the sinus. I have never used these except on the cadaver, and in this way have learned their danger, at least in my own hands. The guard is about 7 mm. behind the point. If the anterior wall is somewhat thick, the edge of the instrument is often directed upward, and when it suddenly penetrates the sinus it is liable to impinge rather sharply against the superior wall. Holmes,²⁸ Onodi,²⁹ Loeb,³⁰ Meyer,³¹ Prentiss³² and many others have reported cases in which a dehiscence was present in this wall and oftentimes the optic nerve was lying free within, only protected by a covering of mucosa. Injury to the sheath could cause blindness on that side and at the same time become the starting point for a subsequent meningitis. This method, compared to the others, has little to recommend it.

Evulsor: The object of this instrument was to penetrate the ostium, then by springing the blades apart to enlarge the opening from within outward, thus working away from the dangerous structures, at the same time bringing the fragments of bone and mucosa into the general nasal cavity³³ (Figs. 9 and 10). In those

26. Zarnico: *Die Krankheiten der Nase*, 1910, p. 691.

27. Gmeinder: *Instrument Catalogue of H. Pfan*, Berlin.

28. Holmes: *The Sphenoidal Cavity and Its Relation to the Eye*, *Arch. Ophth.*, 1896, xxv, 460.

29. Onodi: *Das Verhältnis der Nervus optikus zu der Keilbeinhöhle*, etc., *Arch. f. Laryngol.*, 1903, xiv, 360.

30. Loeb: *A Study of the Anatomic Relations of the Optic Nerve to the Accessory Sinuses*, *Ann. Otol.*, June, 1909.

31. Meyer: *Sinister Unrecorded Anomalies of the Sphenoid*, *Ann. Otol.*, June, 1915, p. 257.

32. Prentiss: *Some Variations in Sphenoid Sinus*, *Jour. Iowa State Med. Soc.*, 1915, p. 263.

33. Skillern, R. H.: *The Present Status of the Radical Operation for Empyema of the Sphenoid Sinus*, *THE JOURNAL A. M. A.*, Dec. 19, 1908, p. 2108.

cases where it is possible to lay bare the ostium it serves its purpose well. On the other hand, unless a straight passage to the anterior wall is obtained, the instrument is too thick to accommodate itself to the

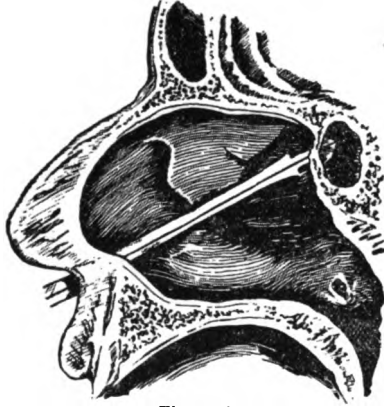


Figure 9.

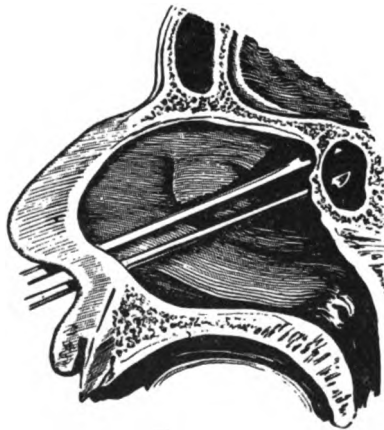


Figure 10.

narrow or crooked route presented. On the whole it is more valuable in the radical method where a large passage is assured with the ostium in plain view.

The Forceps: Luc³⁴ used his ethmoid crushing forceps in order to reach and open the sphenoid, but Faraci³⁵ has constructed a bone biting forceps which are ideal for the purpose. They are exceedingly thin but strong and have a lance shaped end. After the ostium is found with the probe, the lance end of the instrument is pressed in and the wall removed from behind forward. Owing to the peculiar construction of the biting end, this can be accomplished with astonishing ease and celerity, and almost as much of the wall can be removed as with the heavier types of forceps, such as Hajek's. This, I think, represents the greatest advance in operations on this structure, and is the present day method of choice in our clinic.

Hand-Burr: The idea of this instrument was conceived by Grayson⁵ for the purpose of making an exploratory opening into the sinus which can also be utilized for therapeutic purposes. The perforation is made as close as possible to the angle of junction of its floor with its internal wall (Fig. 11) and is 2 mm. in diameter, a size claimed to be quite sufficient to permit the escape of any fluid from within the sinus or the introduction of the jaw of a biting forceps for the purpose of enlarging the breach. He contends that the opening is perfectly situated for drainage and one through which the cavity can be thoroughly cleansed, and also advocates beginning the radical operation at this point. The value of this procedure can be judged by comparing its advantages and disadvantages, both practical and theoretical.

Advantages.—Anatomic: All things being considered, it attacks that portion of the sinus wall most available to instrumentation. It is easy to accomplish as far as the actual manipulations are concerned. Its only danger is the possibility of wounding the sphenoid artery. It can be applied when the anterior face of the sinus is difficult of access.

34. Luc: *Leçons sur les suppurations de L'oreille*, 1910, p. 369.

35. Faraci: *Ferguson's Instrument Catalogue*, Philadelphia.

Disadvantages.—Anatomic: The thickness of the sinus wall as well as the hypertrophy of the diseased lining mucosa may prevent reliable conclusions from being drawn as to the pathologic state of the interior. Logan Turner has shown that even after an extensive breach has been made, it is difficult to judge the exact condition of the mucosa without a bacteriologic examination, as disease can be present without immediate manifestations after the sinus is opened. I have substantiated this statement in a considerable number of cases. Even if the sinus contained large quantities of pus, the opening is so small that during lavage such a slight amount would be brought out at once that it



Figure 11.

would be lost in the interstices of the posterior nares before it appeared in the pus basin. Another factor: the burr is so short and dull that it enters so slowly as to easily lift up the thickened mucosa from the underlying bone, thus causing the attempts to irrigate abortive. Accepting, however, that the exploration had been successful and pus had been found, the opening is too small to permit sufficient drainage or effective treatment, which are further made more difficult by the tendency of the wound to close, which it does, as Grayson admits, in twenty-four hours.

As a starting point for the radical operation, such a small opening (2 mm.) particularly when the bone is thick, as it is so prone to be in this particular locality, offers but a poor hold for any sphenoid forceps except possibly the Faraci, which one would hesitate to use on account of the grave risk of breaking the point off in the sinus.

Local or General Anesthesia.—In all intranasal operations on the sphenoid sinus (except in children), local anesthesia as far preferable, for it is a great advantage to have the cooperation of the patient. The pain is practically nil, the one unpleasant feature being the crunching and crackling of bone so deep within the nose. Only in those cases where the patient is extremely nervous or the disease has so far progressed that he is semimoribund, is general anesthesia indicated. In these cases a rapid and thorough operation is required in order that the patient can be returned to bed as quickly as possible with the least possible shock.

POSSIBLE ACCIDENTS DURING OPERATION

Hemorrhage.—Under ordinary circumstances the bleeding met with during and after the operation is trivial, provided one does not go down too deep into the sinus floor. The source of dangerous hemorrhages while opening the sinus is the sphenoidal branch of the nasopalatine which traverses its floor. After the sinus is opened, the cavernous sinus lying laterally is to be avoided, as two cases of accidental injury to these veins during curettement have been reported. One was fortunately controlled by tampons, but the other resulted fatally.³⁶

Rhinorrhoea Cerebrospinalis.—The escape of cerebrospinal fluid has also been encountered³⁶ in these cases; the gradual discharge continued for about twenty-four hours, and then ceased without apparently producing any untoward symptoms.

36. Glas: *Rhinorrhoea Cerebro-Spinalis*, Wien. *Laryng. Gesellsch.*, Cent. f. *Laryngol.*, 1904, p. 154. Decherd, H. B.: Personal communication.

During Irrigation.—After the sinus has been thoroughly opened, it is unwise to irrigate except under very slight pressure, as symptoms of cerebral irritation (vomiting and unconsciousness) have followed its use.³⁷

Applications of Strong Antiseptics to the Sinus Mucosa.—It is unwise to apply any irritating solutions directly after an operation, as the already inflamed mucosa shows a great tendency to postoperative swelling. Silver nitrate in particular will often cause an exacerbation of the symptoms and retard resolution.

Packing Tightly With Gauze.—If one wishes to provoke alarming symptoms, this procedure will certainly accomplish the result. Hajek³⁸ long ago called attention to it, and I can substantiate his experiences. All the signs of beginning cerebral involvement appear and continue until the packing is removed, and indeed not infrequently for some days thereafter. The irritation to the mucosa produces a swelling which cannot be taken up by the tight gauze packing; consequently there results great pressure within the sinus.

AFTER-TREATMENT

Subsequent treatment is as a rule simple. The one object is to provide sufficient drainage and aeration to the diseased mucosa. Directly following the operation it may swell up into a thick edematous cushion which nearly fills the sinus, due to postoperative reaction. On inspection actual polypoid hypertrophies may be present. One is tempted to use the curet at this stage, but it is interdicted. The swelling usually subsides in a few days under proper drainage, and I have seen actual polyps disappear spontaneously. If after a week or ten days necrotic spots still persist, the curet may be gently used (only on the floor and septum) to remove them.⁶

37. Curtis: The Sphenoidal Sinus (Case), *Laryngoscope*, 1904, p. 866.

38. Hajek: Fall von Empyem der Keilbeinhöhle mit bedrohlichen Stauungserscheinungen, *Wien. med. Wchnschr.*, 1895, Nos. 32, 33.

As the opening shows a great tendency to close through granulation tissue springing up, the edges should occasionally be touched with a bead of silver nitrate. Postoperative hemorrhage has been known to occur as late as the fifteenth day;³⁹ five cases also have been reported as occurring on the seventh to tenth,⁴⁰ one of which³⁹ required ligation of the external carotid.

As far as tampons are concerned they had best be entirely omitted. The sinus will drain better without them and it is now the consensus of opinion that to promote healing they are without value and may even exert deleterious influences. Only for the purpose of controlling hemorrhage should they be placed in the sphenoid sinus. Even though there is not much pain, it is well to administer⁴¹ an opiate in the evening to insure a good night's rest.

IMMEDIATE AND ULTIMATE RESULTS

Conservative Method.—In those cases in which the mucosa only requires aeration and better drainage in order to throw off the inflammatory process, the simple enlargement of the ostium without injury to the adjoining structures will give brilliant results. The relief to the patient is almost immediate with practically no discomfort in the form of pain or hemorrhage. After the slight postoperative swelling subsides, the nose looks, and is to all intents and purposes, perfectly normal. It is true that the enlarged ostium rapidly contracts until it assumes its original size, but in the meantime the patient has become cured.

Radical Method.—It is often marvelous, the effect on the symptoms which this operation produces even in

39. Myles: Trephining and Curettage of the Sphenoidal Sinus: Profuse Secondary Hemorrhage Requiring Ligation of the External Carotid, *Laryngoscope*, 1903, p. 293.

40. Hinkel: Symptoms and Treatment of Chronic Empyema of the Sphenoidal Sinus, *Laryngoscope*, 1902, p. 736. Gleitsmann: Discussion, *Tr. Am. Laryngol. Soc.*, 1895, p. 91. Hepburn: Discussion: *Tr. Am. Laryngol., Rhin. and Otol. Soc.*, 1901, p. 68. Hajek: *Nebenhöhlen der Nase*, 1915, p. 379. Boenninghaus: *Handbuch der Speziellen Chirurgie*, 1913, iii, 212.

41. Hajek: Experiences in the Endonasal Radical Operation upon the Sphenoid Cavity, *Ann. Otol.*, March, 1909.

the severest cases. The excruciating pain is almost instantly relieved or at least so mitigated as to become bearable; ⁴² the patient seems at once to be transported into another atmosphere, from a desperately sick individual to one that is on the road to recovery. Meningeal symptoms⁴³ and cerebral manifestations⁴⁴ rapidly begin to clear up. Kander⁴⁵ and Avellis⁴⁶ have reported cases which had gone on to meningitis cured, to which I can add two more. One patient was moribund and had been so for forty-eight hours and required practically no anesthetic at the time of operation. Four hours afterward he was demanding something to eat. The temperature curve assumes a more normal one and the patient usually goes on to uneventful recovery.

As far as the parts themselves are concerned, one would expect considerable reaction to follow such an extensive procedure (removal of middle turbinate, posterior ethmoid cells and anterior wall of sphenoid sinus), but such is usually not the case. The patients complain of little pain, although there is constant leakage of serosanguineous fluid for eighteen to twenty-four hours. The internal engorgement is marked, which usually sympathetically affects the opposite side, compelling the patient to breathe through the mouth until it becomes reduced, which usually begins to occur at the end of the second day. The swelling gradually subsides until the normal is reached, which is from the seventh to the tenth day.

Nature seems to take care of the void in the same manner as it does the tonsillar fossa after a tonsillectomy, as it becomes more or less filled with granulation tissue (Fig. 12). I might add that I have never

42. Skillern: Ein Fall von Geschlossenen Empyem, *Ztschr. f. Laryngol.*, 1909, i, 337.

43. Solenberger: Sphenoid Disease with Brain Symptoms, *Colorado Med.*, September, 1914.

44. Thomson, St. Clair: Cerebral and Ophthalmic Complications in Sphenoidal Sinusitis, *Brit. Med. Jour.*, 1906, ii, 768.

45. Kander: Meningitis beim Keilbeinhöhlen Empyem mit Ausgang in Heilung, *Verein Süddeutsch., Laryngol.*, 1907, p. 109.

46. Avellis: Ortliche seröse Meningitis bei akuter Keilbeineiterung, *Verein Süddeutsch. Laryngol.*, 1907, p. 116.

seen a dry nose follow this operation, no matter how extensive the procedure.

Concerning the sinus itself, a large percentage recover entirely;⁴⁷ but it must be remembered that its resistance is lowered, and will become reinfected with subsequent attacks of coryza with the reformation and secretion of pus. This, however, clears up readily under appropriate treatment.

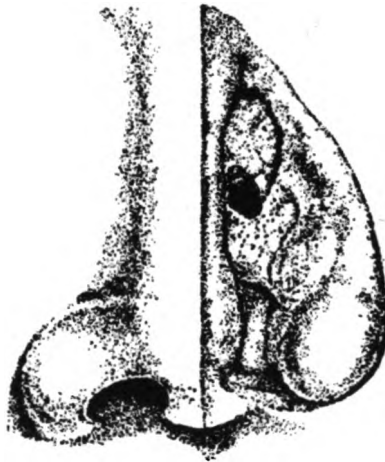


Figure 12.

VALUE OF OPERATION

It would seem almost superfluous from what has been said to discuss this phase of the subject. While its curative value alone in sinus disease makes it invaluable to the rhinologist, the brilliant and dramatic results are those obtained when grave cerebral and orbital symptoms have supervened. Many cases of progressive blindness have been reported which recovered their vision.⁴⁸ I can substantiate these results in several incidents. Many other ocular conditions as

47. Fraser and Verel: An Analysis of Seventy-Six Consecutive Operations on the Frontal, Maxillary, Ethmoidal and Sphenoidal Sinuses, *Jour. Laryngol.*, 1913, p. 69.

48. Brophy: Report of Three Cases of Monocular Blindness Due to Sinus Obstruction, with Recovery of Vision, *Ophth. Rec.*, 1915, p. 351. Stark, H. H.: Sudden Blindness Due to Suppuration of the Accessory Nasal Sinuses, *THE JOURNAL A. M. A.*, Oct. 30, 1915, p. 1513.

well as symptoms remote from the seat of infection have been cured by a timely radical operation on the sphenoid.

Sitting, then, in calm judgment on the merits and demerits of the endonasal sphenoid operation, one must necessarily come to the conclusion that on account of the almost uniformly brilliant results obtained and its comparative freedom from danger, it must be classed as a procedure that no rhinologist of the present can afford not to master.

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THE OBLIQUE METHOD OF ROENTGEN- OGRAPHY OF THE ETHMOID AND SPHENOID CELLS

SAMUEL IGLAUER, B.S., M.D.
CINCINNATI

The usual method of roentgenography of the accessory cavities of the nose consists in directing the rays through the sagittal axis of the skull and intercepting them on a photographic plate placed immediately in front of the patient's face.

The roentgenograms obtained in this manner delineate the normal and diseased frontal sinuses and antrums in an entirely satisfactory manner, but on the other hand, the sphenoid projection is of practically no value. The ethmoid labyrinth of each side is also outlined on the plate, but not so satisfactorily as the frontal sinuses and maxillary antrums. This is due to the fact that in the sagittal roentgenogram the ethmoid and sphenoid cells lie in a row vertical to the plate, and thus the outline of one cell overlaps the other, rendering it difficult to distinguish disease of the anterior from that of the posterior group of cells. However, since the posterior ethmoids project farther into the orbit than the anterior ethmoids, abnormal blurring corresponding to the position of the former group may indicate their disease.

Full profile roentgenograms (bitemporal) give important information concerning topographic anatomic relations, but since the cell outlines of one side are directly superimposed on those of the other, they are comparatively valueless for diagnostic purposes.

Roentgenograms taken in the vertical axis of the skull with the plate either under the chin or at the

vertex (Scheier,¹ Pfeiffer²) delineate the ethmoid and sphenoid cells, but are usually too indistinct for accurate diagnosis. As Skillern³ puts it, "the posterior ethmoid and sphenoid are not always successfully skiagraphed, but there is every reason to believe that these will also be accessible as our technic becomes more and more perfect."

The Oblique Method.—The remaining method of roentgenography of the ethmoids and sphenoids is the oblique method, introduced by Rhese⁴ some years ago, but never generally adopted either here or abroad. As I shall endeavor to show in this paper, Rhese's method is the most valuable of all for the study of ethmoid and sphenoid disease, but the difficulty attendant on the reading of oblique roentgenograms has probably interfered, to some extent, with its more general adoption.

The technical objections to the method now no longer exist, as demonstrated by Dr. Charles Goosmann, who very kindly undertook the roentgenography for me, and to whom I am greatly indebted for valuable advice and cooperation. In passing I may state that at my suggestion an attempt was made to obtain roentgenograms of the ethmoids on photographic films placed within the nose, but these could not be accurately read, owing to the small field under exposure.

Rhese's technic is as follows: The patient lies on his side on the table with his face in contact with the photographic plate. (The position is that of a person sleeping on his side, his arm under his head representing the plate.) The head is in contact with the plate at three points, namely, the malar eminence, the outer edge of the supra-orbital margin and the tip of the nose. The central rays go through the upper

1. Scheier, Max: Die Bedeutung der Roentgenstrahlen für die Erkrankungen der nasalen Nebenhöhlen, Beitr. z. Anat., Physiol., Path. u. Therap. d. Ohres, d. Nase u. d. Halses, 1908, i, 402.

2. Pfeiffer, W.: Eine neue roentgenographische Darstellungsmethode der Keilbeinhöhlen, Arch. f. Laryngol. u. Rhinol., 1910, xxiii, 420.

3. Skillern, R.: Accessory Sinuses of the Nose, Philadelphia, 1913.

4. Rhese: Die chronischen Entzündungen der Siebbeinzellen und der Keilbeinhöhle; mit besonderer Berücksichtigung ihrer Beziehung zur allgemeinen Medizin und ihrer Diagnostik durch das Roentgenverfahren, Arch. f. Laryngol. u. Rhinol., 1910, xxiv, 383. Sonnenkalb: Die Roentgen Diagnostik des Nasen und Ohrenarztes, Jena, 1914, p. 76.

edge of the auricle, and are thus directed obliquely through the head, but vertically on the plate (Fig. 1).

A study of Figure 1 shows the lines in which the sphenoid and ethmoids of the side nearest the plate are projected. The posterior-superior portion of the sphenoid, *S*, on the near side, is left uncovered by the sphenoid of the far side. The posterior-ethmoid group is projected immediately anterior to the sphenoid sinus and is overlapped by the sphenoid and ethmoids of the far side. The anterior ethmoids are overlapped by the ethmoids of the far side. The upper portion of the anterior ethmoids, that is, "the fronto-ethmoids," are projected on the plate without any overlapping from the opposite side.

Since the sphenoid and the ethmoid labyrinth on the side nearest the plate are separated from the latter by the short distance equivalent to the depth of the orbit, they naturally come out distinct in the roentgenogram. For purposes of comparison a plate must be made of each side.

The Normal Sphenoid and Ethmoids.—In the oblique roentgenograms there are certain fairly constant lines or landmarks which aid in the reading of the plates. The margin of the orbit appears as a circle and the two orbits together give the impression of a pair of large-rimmed glasses resting on the nose. Within the circle of the orbit which was in contact with the plate a horizontal line will be noted crossing the median wall and representing the suture line between the lamina papyracea and the frontal bone. The superior fissure of the orbit is represented by a line descending vertically in the posterior part of the orbit. Parallel to this line and about one-half inch anterior thereto a second line descends through the orbit and represents the line of junction of the bony septum with the anterior sphenoid face. At the junction of the posterior vertical line and the horizontal line there is a small circle corresponding to the optic foramen. The sphenoid sinus appears as a rhomboid or

oval approximately bounded by the two vertical lines. By placing a probe in the sphenoid sinus of a patient and making plates both in the lateral and oblique positions the reading of the sphenoid portion was proved to be correct. The ethmoid cells are bounded above by the horizontal line alone and below by the margin of the orbit, and the fronto-ethmoid cells are noted anteriorly near the floor of the frontal sinus. The latter are clearly shown and the malar eminence is a prominent landmark (Figs. 2 and 3).

If one sets up a mental image of the structures in contact with the median wall of the orbit and adjacent to it, and imagines these structures projected onto this wall, the reading of the plate is much simplified.

The Pathologic Ethmoids and Sphenoid.—When the sphenoid or ethmoid cells contain pus, hyperplastic or neoplastic tissue, the roentgenogram usually reveals the diseased condition. The crisp, sharp normal lines are more or less obliterated and replaced by blurred, washed out or indistinct contours. The pathologic tissue may be revealed as an abnormal shadow of greater or lesser density, varying with the nature and seat of the disease process (Figs. 4 and 5).

With sphenoidal disease the blurring occurs in the posterior part of the orbit. Posterior ethmoidal disease is outlined in the middle portion of the orbit, while with the anterior ethmoiditis the blurring occurs farther forward near the outlines of the nasal process of the superior maxilla (Fig. 6).

The fact that the oblique roentgenogram enables one to locate disease of the anterior or posterior ethmoids or of the sphenoid itself constitutes the chief advantage of this method. In each of two cases an unsuspected polyp was found within the sphenoid when it was opened. In numerous cases controlled by operation, ethmoid disease was accurately located as predicted from the roentgenogram. When polypi were present the larger ones were removed prior to making the Roentgen-ray plates, in order to obviate obscuration

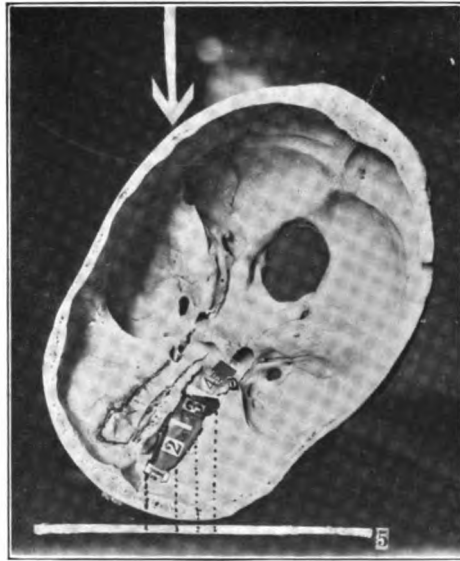


Fig. 1.—Position of skull, and direction of central rays, marked by arrow; 5, Roentgen-ray plate; 1, roof of frontal sinus; 2, of anterior ethmoids; 3, of posterior ethmoids; 4, of sphenoid. Dotted lines indicate projection onto plate.

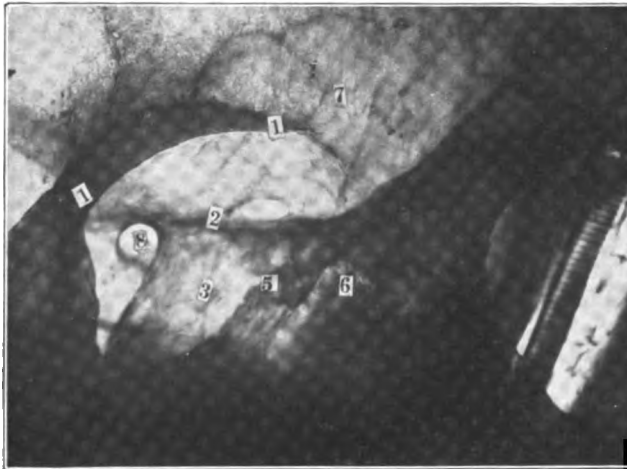


Fig. 2.—Roentgenogram of dry skull (right side): 1, 1, orbital margin; 2, suture line between frontal bone and lamina papyracea; 3, sphenoid; 5, posterior ethmoids; 6, anterior ethmoids; 7, frontal sinus; 8, optic foramen.



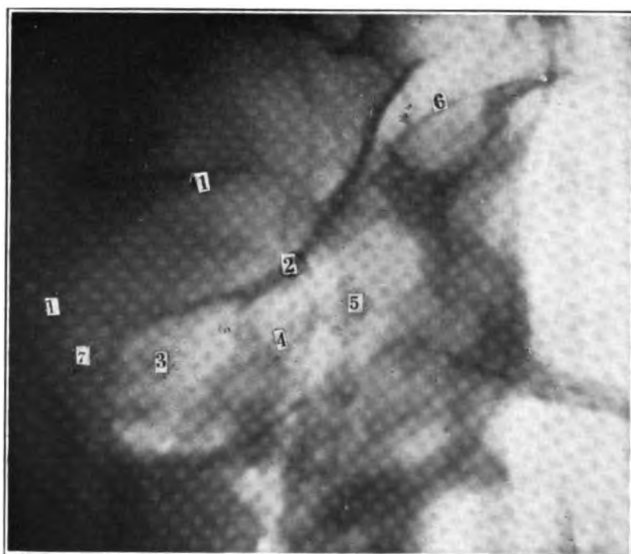


Fig. 3.—Roentgenogram of normal cavities in an adult (right side): 1, 1, orbital margin; 2, suture line; 3, sphenoid; 4, posterior ethmoids; 5, anterior ethmoids; 6, frontal sinus; 7, optic foramen.

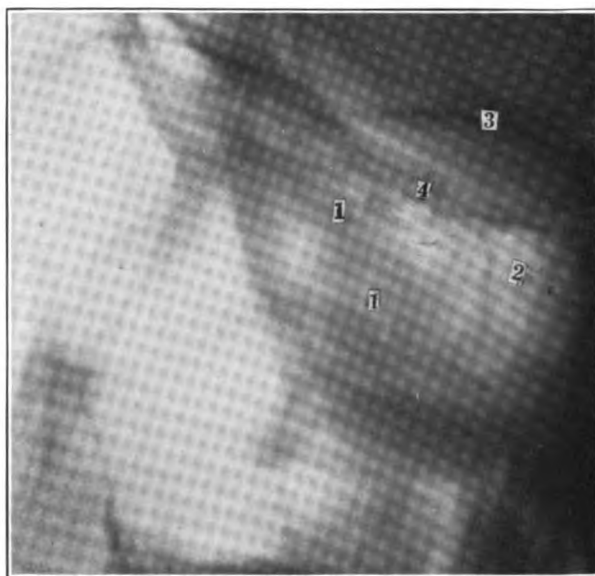


Fig. 4.—Roentgenogram showing anterior ethmoiditis at 1, 1; 2, normal sphenoid; 3, orbital margin; 4, suture line. Note blurring in diseased areas (left side).

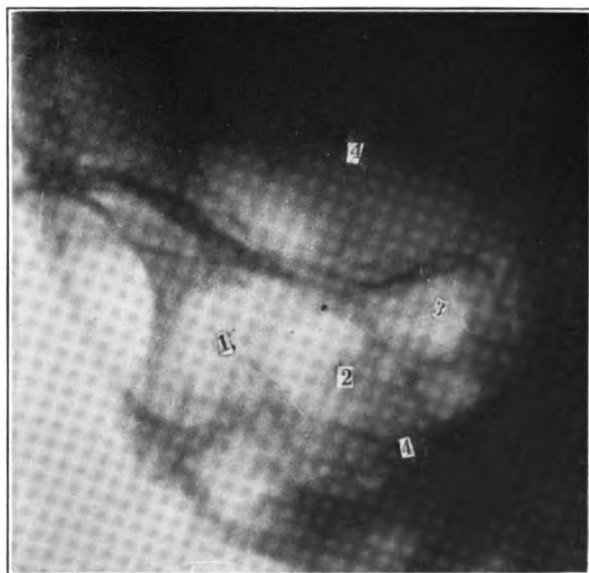


Fig. 5.—Roentgenogram showing 1, anterior and 2, posterior ethmoiditis; 3, normal sphenoid; 4, orbital margin. Note blurring in diseased areas (left side).

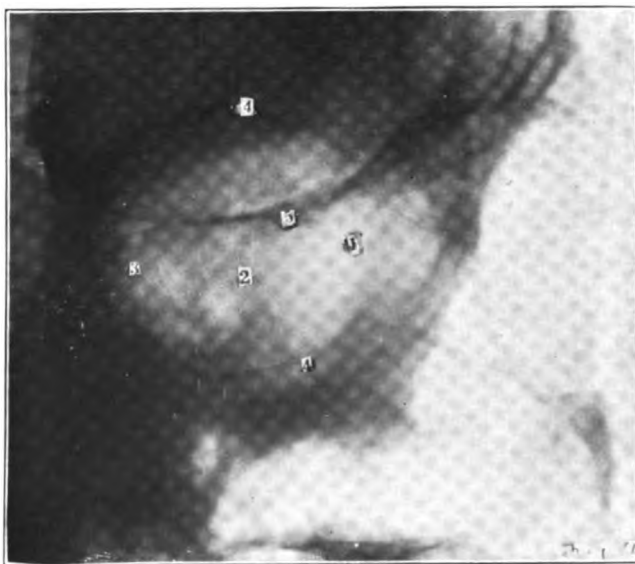


Fig. 6.—Roentgenogram showing involvement of 1, anterior, and 2, posterior ethmoids, and 3, the sphenoid. 4, 4, orbital margin; 5, suture line (right side).



of the ethmoid outlines by the polypi. In practically every polyp case a concomitant ethmoiditis was revealed by the Roentgen ray.

It frequently happened that ethmoiditis was not depicted on the frontal plate taken in each case, but was clearly shown on the oblique plate. However, the accuracy of diagnosis will be increased by employing both methods, which should be done in all cases. While positive plates are of great value in checking up clinical findings, negative plates in doubtful cases are also important and may prevent needless operations. This was well illustrated in the case of a physician who had elsewhere been told that he required an ethmoid operation. As soon as he was informed that his plates were negative all of his symptoms disappeared.

It should not be assumed, however, that absolute reliance can be placed in the roentgenograms without regard to clinical symptoms. In a few cases the plates proved misleading, since operation failed to entirely confirm the roentgenogram diagnosis. Sources of error are encountered if the sinuses of the two sides vary considerably in the natural thickness of their walls, with a resulting contrast in the roentgenogram. Furthermore, as pointed out by Rhese⁴ and as we know from transillumination, a healed process in an accessory cavity may still appear as an abnormal shadow. As a general rule, however, reliance may be placed in the Roentgen findings.

Considering the important anatomic relations of the sphenoidal and ethmoidal cavities as well as the possible dangers attendant on operations therein, we should make careful clinical study of each case, and in addition, roentgenography should be employed as one of our most valuable aids to diagnosis.

SUMMARY

The usual methods of roentgenography of the sphenoid and ethmoid cells give uncertain results.

The oblique method is the most valuable and accurate.

Both the oblique and sagittal methods should be employed.

The roentgenogram is a great aid to diagnosis and should be combined with careful clinical study.

In conclusion, I desire to express my appreciation of the kindness of Drs. W. Mithoefer, R. Stevenson and J. Murphy in placing some of their cases at my disposal for roentgen study.

22 West Seventh Street.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. BECK, HURD, COTT, SHAMBAUGH, SAUER,
SMITH, LOEB, SKILLERN AND IGLAUER

DR. H. P. MOSHER, Boston: Dr. Skillern misunderstood my method of opening the front wall of the sphenoid. I do not enter the sphenoid through the ethmoidal part of the front wall. After uncovering the whole of the front wall of the sphenoid, entrance to the sinus is gained through the nasal part, preferably by way of the ostium. Dr. Skillern spoke of pushing the mucous membrane ahead as you attempt to get into the sphenoidal sinus through the ostium. I have had two such cases and in one the mucous membrane pulsated. I have never used Beck's osteoplastic operation on the frontal sinus. Jansen's work prejudiced me against procedures of this class. The pathology in Dr. Beck's paper was most welcome.

Dr. Beck was favorably impressed with the Lothrop operation. I have done the operation once. There are many things which appeal to me about this operation. Men have been working on the superior nasal spine for years. Such operations have seemed to me to be working in the dark and I have never tried them. The great improvement introduced by Lothrop is that he opens the frontal sinus and works on the superior nasal spine by sight. The second new point about this operation is that both superior nasal spines are removed. In the operation which I saw Dr. Lothrop do it seemed to me that the opening in the front wall of the frontal sinus was too small. Given a large opening to work through, the Lothrop operation appeals to me, and I think it has a future ahead of it. Time will have to settle whether the opening made through the thick bone of the superior nasal spines will fill with scar tissue any faster or to a greater extent than the opening made by the Killian operation in the thin bone of the ethmoid labyrinth and the floor of the frontal sinus. The papers today have shown that there is more than one technic for exenterating the ethmoidal cells. The operator should take whichever one best fits his needs. As given in the papers today the approach to the ethmoidal labyrinth has been through the ethmoidal bulla. The point of attack which I have been accustomed to make is through the extreme upper anterior part of the middle turbinate. In performing the exenteration of the ethmoidal labyrinth I have reduced the special instruments employed to two, a Hammond mastoid curet and a small round tonsil punch about a centimeter in each diameter. Whether one works to the inside or the outside of the middle turbinate, ethmoidal operating is dangerous and always will be. Anyone who does ethmoidal operating should have an acutely developed surgical conscience. Packing the nose after an ethmoidal exenteration is dangerous.

Pus should be held in the nose as short time as possible. In the cases of ethmoidal exenteration which I have not packed the majority have required packing later by the house surgeon.

DR. C. G. DWIGHT, Madison, Wis.: Every man who has done any surgery along this line has his own technic; if not, let him master a technic that is considered safe and right. I have repeatedly left the concha media and middle turbinate as a landmark in doing ethmoid work. If you will enter at the upper anterior end of the middle turbinate with a Hartman forceps and work back until you have exposed the anterior ethmoid cell, you have an easy route to follow. It allows you to work back and leave the middle turbinate hanging.

DR. LEE COHEN, Baltimore: Dr. Beck emphasized the difficulty of keeping the fronto-nasal duct from closing. This, in my experience, has also been the greatest difficulty in the treatment of frontal sinusitis. Dr. Ingalls of Chicago, several years ago advocated the introduction of a gold tube into the frontal sinus to maintain drainage. For the past several years it has been my custom to introduce a rubber drainage tube into the frontal sinus when intra-nasal drainage of this sinus is required. The introduction of this flexible tube might at first thought seem quite difficult, but if a piece of drainage tube five inches long, varying from one-eighth to one-fourth inch in diameter, according to the needs of the individual case, is slid over an ordinary Ritter bougie, its introduction will be found quite simple. The tube should be fenestrated for about one inch from the end first introduced, and in order that it may not be necessary to cut the tube off within the nose after its introduction, it may be cut into two sections before putting it over the bougie. The section near the handle of the bougie serves simply as a means to slide the fenestrated portion of the tube off the bougie, after its introduction into the frontal sinus. The sinus can be treated by irrigation if desired, by the introduction of a small silver cannula into the lower end of the rubber tube. Two weeks after operation the drainage tube is removed, leaving a nice round opening, the walls of which have healed fairly well without contraction, on account of the presence of the tube. In some instances where pus still forms in the sinus, it may be necessary to reintroduce the tube several times for intervals of a week or two, before suppuration finally ceases. In a number of cases treated in this way during the past several years, satisfactory results have been obtained, after failure following other operations.

DR. HARVARD M. McNAUGHT, San Francisco: Last year I reported ninety consecutive cases of maxillary antrum operation by the intra-nasal method. These cases were done with the purpose of ascertaining what proportion of cases are

curable by the simple intra-nasal operation. I use a modified Krause operation. About 85 per cent. of intra-nasal involvements result in cure without radical operation. Another point that has not been emphasized is the use of intra-nasal irrigation. I emphatically condemn intra-nasal irrigation for sinus infection. You get a dehydrating or water-logging effect. The tissues will store up the different salts or give them out and you produce an irritating effect which in many cases keeps up secretions that you want to disappear. We only use a wash for a week or two after operation, then rely chiefly on silver nitrate solutions, in varying strengths, sometimes as high as 50 per cent., and we find we get better results.

DR. FRANCIS WALTER, Toledo, Ohio: I am of the opinion that some of these cases can only be cured by the combined internal and external operations. I have not had the extreme strenuous experience Dr. Beck mentions in connection with the bad cosmetic effect from the Killian operation. Without a doubt it is a deforming operation, and the deformity is not easily borne by the average patient. It has been my experience that this feature of the Killian operation can to some extent, at least, be minimized and made less noticeable by limiting the anterior opening into the sinus. One must have a generous enough opening to inspect the sinus, but there is no absolute need to make the external opening correspond to the sinus itself. In a series of fifteen operations the results in nearly all of the cases have been very gratifying as far as a cessation of the pathologic process is concerned, but somewhat variable as to the amount of the deformity.

I have had a larger percentage of male than female patients. Obviously it is easier for a man to bear with the resultant deformity. In all but two cases, which were among my first, I was exceedingly careful to do thorough intra-nasal work. When I failed to do this I was compelled to reoperate because of reinfection. This is a point which cannot be emphasized too strongly. We should precede the external operation by thorough removal of the middle turbinate and a careful exenteration of the ethmoid cells. The main indications for the external operation are: (1) A persistent discharge which cannot be lessened by the well known methods, especially when associated with severe headaches. (2) A spontaneous fistulous opening existing over the sinus. I was much impressed with Dr. Beck's operation. The only criticism I have to offer is that the technic is too involved for the average operator. Some method must be provided to eliminate and cure these pathological frontal sinuses and yet leave no cause for regret as far as the cosmetic element is concerned.

DR. J. F. BARNHILL, Indianapolis: An operation which provides only a small opening into the frontal sinus for the purpose of work in this sinus seems to me to be a bad one. It is observable in nearly all operative work of throat men that they seem to be too much afraid of an adequate opening. Frequently the small opening will not heal at all for the reason that through it the disease cannot be thoroughly eradicated and will, therefore, make a great deal of subsequent trouble, whereas a large opening through which the diseased portion may be removed, heals rapidly and entirely satisfactorily. Now with these facts in view I cannot see why we should make a small opening and try, usually unsuccessfully, to clear out all of the diseased tissue of the sinus, when a larger opening will enable the operator to do the work in the open, and therefore more surgically correct and better in every way. A point that has not been mentioned here is that in these chronic sinus conditions for which we do this operation the entire mucous membrane is usually so thickened and diseased that the entire sinus is often filled with this degenerated membrane. Anyone who does not curet out every bit of this mucous membrane will not, in all probability, cure his case. If he leaves some of it in any of the numerous angular pockets of the sinus, or in any part of the sinus we may be sure it will grow and fill the sinus again with the result that failure is almost certain. Satisfactory work can therefore only be done through a large opening.

DR. CULLEN F. WELTY, San Francisco: I wish to mention one thing in relation to the ethmoid that has not been stated clearly, if at all, and that is leaving the middle turbinate and taking your ethmoid away. In selected cases it is a recognized procedure, and one that will lead to many good results. If you have not a polyp formation in the middle turbinate, in many instances, you will cure that case absolutely by taking away the ethmoid and leaving the turbinate. I also insist on correcting the septum before destroying the ethmoid. In many individuals, the septum encroaches on the ethmoid and produces something that simulates ethmoiditis. By correcting the septum you do away with the ethmoiditis. The most important question to be decided in a case of suppuration of the antrum of Highmore is which operation you are going to do.

When polypi and hypertrophies are found in a nose that has a suppuration of the antrum of Highmore (frontal excluded), it is quite apparent that something in the line of a very thorough operation is necessary to bring the case to complete healing. I never operate for drainage. The only operation that will do this is the Luc-Caldwell with my modification of leaving the inferior turbinate intact. When this case has recovered, it will require a most careful examination to determine that the nose has been operated on at all. In other words, an operation on the antrum of Highmore that

leaves the nose intact so far as one can see, has a decided preference over all other operative procedures that destroy a whole or part of the inferior turbinate. A suppurative of the antrum of Highmore (frontal excluded) that does not show pathology in the nose (such as polypi and hypertrophies) will in a great majority of cases get well by irrigation. It is my contention that many of these more or less interesting operations that destroy the integrity of the nose are unnecessary. Furthermore, if an operation on the antrum of Highmore is necessary, the more completely the operation is done the more sure you will be of a permanent cure. I strictly confine my remarks to chronic cases and they are not chronic until they have lasted a year or more.

DR. M. WILLIAM CLIFT, Flint, Mich.: Dr. Inglauer brought out very well the difficulty of showing the sphenoid. The oblique method is difficult of interpretation. About two years ago I started to work out a method of showing the sphenoid by roentgenography, and at the present time I am using a dental film slightly larger than the ordinary size, which is placed in the mouth horizontally, back as far as possible, and the patient closes his teeth over the film. The ray passes through at an angle between the vertex and occipital protuberance. The angle must vary somewhat according to the type of skull met with. It is approximately 45 degrees in the average case. The advantages of the method are obvious. The first advantage from the Roentgen standpoint is the fact that the film lies very close to the sphenoid. It is comparatively close to the roof of the mouth and the tissues to be penetrated are few. The second point is the fact that the sphenoid itself is shown clearly on the film without the overlying shadows of the ethmoid cells. By this method the infection of one side of the sphenoid can be shown clearly and the outlines of the normal side are demonstrable as well. The third point is that there is very little distortion of the shadow from the fact that the film is close to the sphenoid.

DR. JOSEPH C. BECK, Chicago: I am still unable to answer Dr. Mosher as to the pathology of a hemorrhagic frontal sinus, because I have not encountered a case that I could say was a hemorrhagic case. I have seen marked dilatation of the blood vessels with some extravasation in acute exacerbation of chronic cases, but nothing that I would consider a hemorrhagic case. I did not urge a modified Killian. I showed that it was very little better than an intranasal procedure so far as a definite cure was concerned. Dr. Barnhill touched on this operation, but his objections are scarcely valid in reference to the Lothrop operation.

The final point is this, that it is a question between you and your patient whether you want to adopt my procedure or the Lothrop operation; whether you want absolute cure or a slight suppuration; whether you want a suppuration which you can

control or a deformity which will remain throughout the rest of the patient's life. The intranasal operation, or a method such as the Lothrop operation, I think will come into their own in frontal sinus work. I feel that just as the Gussenbauer, Kuster, Cooper and Jansen operations have gone, so, perhaps, my operation will go; but twenty-seven cases out of thirty-one being successful, without any deformity except some suppurative, is a good record. I believe the Lothrop operation as a late procedure after all has been done intranasally will be the best.

As to Dr. Iglauer's paper, a stereoscopic roentgenogram viewed from both sides, that is, stereoscopic and pseudoscopic, will give more information than the unilateral, distorted picture. Why Dr. Sauer did not mention the procedure of completely obliterating the antrum of Highmore by the method I devised, the only means that I know that will cure an otherwise incurable chronic suppuration after other simpler methods have failed, is the question I would ask. It has been published over five years.

DR. GEORGE F. COTT, Buffalo: Dr. Shambaugh claims that operation is for the relief of hyperplastic or suppurative ethmoiditis. The logical conclusion then is that operation should not be performed except when one of these conditions is present. However, a healed suppurative ethmoiditis may cause such distressing symptoms, although there is practically no discharge, that nothing suffices but operation. During the time I attended the Jansen clinic in Berlin in 1908 I found that he had operated 800 cases radically, and I asked one of his assistants how many recovered, and he said none. That may have been considerably exaggerated, and I do not think it was correct, but there are a large number that do not get well. The ethmoid operation is more or less dangerous, perhaps more than most. I saw Dr. Mosher demonstrate the operation in Boston, and he had had at that time seven cases. Since I have been operating, not only for suppuration but for a latent condition, I have tabulated fifty cases not including ward or dispensary cases, and I think there will probably be from 75 to 100 per cent. without a fatal result. You will find that operations on the ethmoid after suppuration has ceased will be at least 100 per cent. more common in the future than in the past, and you will not get relief from the trouble unless you drain the cells. That does not mean to drain a case because there is pus there, but to obtain pneumatic drainage.

In regard to the Roentgen ray, it is absolutely useless in the cases that have had suppuration. I have tried it and have discarded it. There is nothing there to see.

DR. GEORGE E. SHAMBAUGH, Chicago: In regard to the question of the disposition of the middle turbinated body: There are a few cases where the nasal chambers are so roomy that it is not necessary to disturb the middle turbinated body

when operating on the ethmoid cells. Under these circumstances it may be advisable often to leave the turbinated body standing. In many cases where the ethmoid operation is called for the nasal chamber is so constricted that it is with difficulty that one gets, even after cocainization of the nasal membranes, a glimpse of the lower edge of the middle turbinated body. Under these circumstances the resection of the concha media precedes any operation on the ethmoid labyrinth. As regards Dr. Cott's suggestion that the first indication for operation on the ethmoid is found in the persistence of symptoms following the disappearance of an acute ethmoiditis, I can hardly follow Dr. Cott in this matter, unless he has in mind the persistence of an ethmoiditis, hyperplastic or suppurative, after an acute infection. As a matter of fact, acute ethmoiditis is a not infrequent complication of acute rhinitis. This process subsides almost invariably without any operative treatment unless there exists a previous hyperplastic ethmoiditis or where the anatomic conditions are such that even slight swelling of the concha media effectually obstructs drainage from the ethmoid. Dr. Welty's point is a good one, that a high deflection of the septum requires correction before the ethmoid can be reached effectively. If the operation is undertaken with the patient lying on the operating table, where the shock is very much diminished, it is usually feasible to correct the septum and complete the operation on the labyrinth at one sitting. The other suggestion by Dr. Welty, that the relief accomplished by an intranasal operation on the accessory sinuses can be got just as well from simple irrigation, I am not willing to accept. I would be almost willing to take the stand that any accessory sinus condition which can be cured by irrigation will get well spontaneously if left alone, with only the usual application of epinephrin or cocain applied under the middle turbinated body to facilitate temporary drainage. It is only, as a rule, the chronic form of accessory sinus disease where an operation is called for, and in these cases irrigation alone is usually of very little value.

DR. SAMUEL IGLAUER, Cincinnati: I have not tried the method Dr. Clift mentioned, although I found some reference to it in the literature. The objection stated in the literature is that the patient cannot control the soft palate and possibly not the tongue while the picture is being taken and therefore there is some danger of the film being moved during the exposure. This difficulty may, perhaps, be overcome by cocain or by a rapid roentgenogram. The film in the mouth method was suggested by Scheier some years ago but nothing seemed to come of it. If this method proves successful it will be better than the method I presented this morning. If it is not successful the oblique method will remain the best. Dr. Beck is inclined to question the value of the latter method. If he will look at the plates perhaps he will change his mind, since it is difficult to show details in lantern slides. I am

convinced that one can tell whether the anterior or posterior group of cells is involved. I think that is valuable. There is one trouble with a patient who has recovered from an ethmoiditis or sphenoiditis, that the recovered cells may still show pathologically on the roentgenogram, so that one must consider the patient's history and the clinical findings in connection with the plate. I do not pretend to say that one should rely on the roentgenogram plate entirely; one certainly must employ clinical methods, but by combining the two fewer mistakes will be made.

THE PREVENTION OF CHRONIC MIDDLE EAR SUPPURATION

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When we consider the frequency with which it occurs, the resistance it offers to treatment, the damage it does to hearing, and the risk it incurs to the life of the individual, the subject of chronic middle ear suppuration becomes one of importance, and the question of how best to prevent it deserves the time and attention of the section that the chairman has seen fit to assign to it.

The prevention of disease is the highest aim of the medical profession. To accomplish successfully this aim we must possess first a knowledge of the disease that we hope to prevent. A comprehensive knowledge of any disease implies a knowledge of the pathology and diagnosis. This applies especially to the subject of chronic middle ear suppuration, for the reason that it is a disease capable of manifesting itself in a variety of ways and liable to many complications. It is not only necessary to recognize the disease when present, but we must actually anticipate it when certain factors are favorable to the development of the disease. Thus we see that a knowledge of the etiology is even more important than a knowledge of the pathology and diagnosis, in that it goes a step farther.

These requirements, a knowledge of the etiology, pathology, and diagnosis, are necessary if we hope to prevent chronic middle ear suppuration.

A knowledge of the diagnosis is essential, for without it we can know nothing about the condition which we are attempting to prevent, nor are we able to say that a particular case is chronic or acute. For instance,

when a patient presents himself for treatment with the history of a running ear lasting over a prolonged period, the diagnosis of chronic middle ear suppuration may be inferred, but should not be concluded, for the evidence is insufficient. The diagnosis must include a knowledge of every feature of the case ascertainable from all available sources of information, including the history; the functional hearing and static tests; the otoscopic examination; the rhinoscopic examination; the skiagraphic examination; the examination of the secretions from the middle ear for consistency, color, odor, etc.; the microscopic examination of the washings from the ear for cholesterin or other crystals; for micro-organisms, including the smear and cultural methods of examination in order to ascertain the nature of the infecting organisms; blood and urinary examinations; in many cases a neurologic examination, and indeed occasionally a general physical examination of the entire body. There is no disease that requires a more exhaustive examination. By such complete methods only are we able to determine, with some degree of certainty, the pathologic conditions that exist in the middle ear, eustachian tube, attic antrum region and mastoid cells; whether the suppuration is an acute or chronic process; whether it is tending toward spontaneous recovery or extension; whether the extension is toward the inner ear or intracranial structures; whether cholesteatoma is present or not; whether the suppuration in the middle ear is producing a detrimental effect on the patient's general condition of health or vice versa. Besides, from the knowledge obtained by a thorough examination combined with experience gained in similar cases, some idea may be formed as to the prognosis with and without treatment and the probable effects of selected treatment. I use the words "selected treatment" advisedly, for the reason that treatment cannot be routine in a disease in which the conditions are so variable as they are in chronic middle ear suppuration.

We have referred to the importance of a comprehensive diagnosis and how the diagnosis depends in a large measure on our knowledge of the pathology, but only in a direct, physical-mathematical sort of way, as determined by laboratory methods. On the other hand, the indirect (predisposing) symptomatic, and, we might add, the physiologic factors, as determined by clinical methods, are not included in the study of pathology. It is these latter features that play an important rôle in the individual susceptibility and variability in the manifestations and course of the disease, so that it would hardly be fair to dismiss the subject of etiology with a mere reference to the pathology.

Since chronic middle ear suppuration is the sequela of acute middle ear suppuration, the prevention of the chronic form is possible only when we are able to arrest the suppurative process while it is still in the acute form. Just how long an ear may discharge before we may class the condition as a chronic middle ear suppuration is a question difficult to answer. Probably no two authorities would agree. It was taught in the Politzer clinic that an ear that discharged for more than two years might be classed as a chronic condition and should be operated on radically, while a discharge lasting for a shorter time was classed as acute and should be operated on after the simple method. Politzer then cited a limited number of exceptions to this rule.

The question of duration is a relatively important one when considered along with other factors, more especially the influence of treatment. For instance, if an ear continues to discharge for more than six months in spite of carefully conducted conservative treatment covering a period of two months or more the writer would be inclined to consider the case chronic, but not necessarily one requiring radical operation.

The treatment of acute middle ear suppuration depends on many factors, local or distant, recent or

remote; the presence or absence of complications, the susceptibility of the patient to a particular infection, and the vitality of the patient, measured by his general resistance to all diseases and his power of recuperation.

Local factors that tend to prolong a case of acute middle ear suppuration may exist in the form of adhesive bands in the middle ear spaces, left there by one or more previous attacks of acute secretory catarrh; narrowing of the eustachian tube anywhere along its course, the result of organized exudate following acute secretory catarrh. Anything which tends to obstruct the free drainage of pus from the middle ear spaces becomes a factor of importance in prolonging an acute middle ear suppuration. The normal route for the escape of middle ear discharge is down the eustachian tube, which is at the same time the most favorable. The reason why discharge finds its way out through a perforation in the drum membrane in the case of acute suppuration of the middle ear is because the normal route down the tube is temporarily closed. It follows, therefore, that when the normal route continues closed beyond a certain period, the suppuration tends to last proportionately long. Drainage down the eustachian tube may be obstructed by inflammatory edema of the mucous membrane, but this is usually transient. The more important obstructions are the organic, and the most frequent of these is to be found in the narrowing that follows the organization of exudate from acute tubal catarrh. The loss of the cilia with metaplasia of the epithelium, in spite of patulousness of the tube, may act as a relative obstruction in that drainage is not favored, as is the case when the epithelium is in normal condition. Very large adenoids may obstruct the orifice of the tube and interfere with normal drainage. A frequent location for obstruction is to be found at the upper end of the tube, or, more properly speaking, in the pre-tympanum. In this location membranous diaphragms

are sometimes formed. The opening in this diaphragm may vary in size at different times in the same individual.

Obstruction in the middle ear cavity may be found in the form of so-called adhesive bands, which tend by their presence to close off partially dead spaces. In one case it may be the attic region, in another the antrum region, and less frequently the hypotympanum. These bands may exist from birth, due to incomplete absorption of the connective tissue that existed there in the embryonal state. More often it is due to the deposition and subsequent organization of exudate following a catarrhal condition. It is this same process that leads eventually to the so-called chronic adhesive process of the middle ear. When the adhesive bands tend to close off the antrum the possibility of complicating mastoiditis is increased. The way to the antrum, instead of being closed off by material bands, may be concentrically narrowed by the organization of exudate from similar causes. Temporary closure, partial or complete, of this region may result from inflammatory swelling of the mucous membrane. The perforation in the tympanic membrane may be too small or unfavorably located to permit of proper drainage, in which case it would be well to enlarge it. My impression is that far more attention is paid to the size of the perforation in the membrane than to the condition of the tube, when in fact obstruction in the tube is by far the more important factor of the two when both conditions are present. The first place to look for imperfect drainage is in the tube; correct it and the size of the perforation often becomes a factor of secondary importance. On the other hand, I do not wish to criticize any one for giving attention to the size of the perforation, but rather for neglect of the tube. Anything that obstructs the free flow of pus from any part of a suppurating middle ear tends to prevent spontaneous recovery and therefore to chronicity. The exact nature of the obstruction should be

sought and corrected by the simplest known method. If the obstruction is due to necrotic areas in the bone, with granulations, or to cholesteatoma, or to large polyps, the condition is already chronic, and a discussion of them would be foreign to our present subject.

When the obstruction can be located and its nature determined, the logical thing to do is to remove it, if possible, by the simplest means at our disposal. When these fail, as they do at times, more radical methods must be adopted, for neglect of drainage will surely result in chronicity if not complications. The question of correcting an obstruction narrows itself down to the diagnostic judgment of the otologist in locating it and his manipulative skill in handling it when it is located.

One thing that I have observed and wish to emphasize is the frequency with which local inflammatory swellings acting as obstructions clear up promptly after a simple mastoid operation. In other words, a simple mastoid operation will side-step an otherwise irremovable barrier to drainage. Nor is this to be wondered at when we consider that an organic obstruction located between the middle ear cavity and the antrum will drain the posterior spaces better by a posterior opening, while the anterior spaces will drain better anteriorly.

A mastoid operation is not to be urged except when other more simple methods have been tried and have failed. On the other hand, the operation should not be postponed in the presence of the indications for operation. By temporizing we may fail to clear up the case by the simple operation and thus necessitate a more radical operation later.

Among the neighboring and more distant conditions that may tend toward prolonging an acute middle ear suppuration may be mentioned adenoids, when extremely large, by blocking the pharyngeal end of the eustachian tube. This has been referred to previously when discussing the question of drainage. Aside from the fact that enlarged adenoids may act

mechanically to obstruct drainage, they may menace the health of the ear in other ways. For instance, the presence of adenoids increases the susceptibility of the patient to infections, and these again tend to increase the size, for the time being, of the already enlarged adenoids. By this means it not infrequently happens that the patient with an acute middle ear suppuration experiences aggravations and added infections from repeated colds; furthermore, the original infection in the nose and throat is prolonged because of their presence. When such conditions prevail it is important to remove the adenoids at a time best suited to the circumstances.

Enlarged and chronically diseased tonsils act in a similar manner, but less directly than do enlarged adenoids. Chronically enlarged tonsils are more susceptible to acute infection than normal tonsils and there is no telling just when a flare-up is going to occur; so that in a case of acute middle ear suppuration that does not tend toward recovery within a reasonable time it is a safe plan to remove the enlarged tonsils along with the adenoids. Success does not always crown our efforts for the reason that there may be other factors tending to make the case chronic.

Nasal obstruction may seem to some a far-fetched cause of chronicity in middle ear suppuration. Nevertheless, experience teaches us that the correction of nasal obstructions act beneficially in all pathologic conditions of the middle ear. Different theories have been advanced to account for it, which I will not take your time to discuss at present. The importance of nasal obstruction in its bearing on suppurative middle ear conditions, although previously recognized by the writer, was further emphasized about a year ago, when, after failing to clear up a case of subacute middle ear suppuration within a reasonable time by the usual conservative methods, the condition promptly cleared up after a submucous resection of the septum performed by another physician to whom the patient

had gone. Embarrassing as it is to confess it, the case is cited because of the lesson it teaches.

A common cause for delayed recovery in acute middle ear suppuration is to be found in the so-called chronic infections, tuberculosis and syphilis, especially the former. A large percentage of the persistent cases of acute suppuration in infancy are tuberculous, when we frequently find the ear conditions associated with enlarged cervical lymphatics. In some of these cases the ear condition had its origin in a tuberculous infection in the middle ear, perhaps masked by the mixed infection that usually follows the breaking down of tubercles. In other cases the primary condition in the ear was due to some other infection, the process never becoming tuberculous; however, the tuberculosis elsewhere in the body acts detrimentally to the health in general and prevents prompt healing of the suppuration in the ear. Early evidence of caries suggests a tuberculous process in the middle ear.

In either event, care of the ear alone will generally fail to bring about a cure. The case should be treated as one of tuberculosis, along general lines, as in the case of tuberculosis in other parts. As is well known, the operative treatment of tuberculous ear conditions is prone to be followed by tuberculous meningitis, especially where the patient's general health is ignored.

Concerning syphilis of the middle ear much less is known and fortunately the condition is rare, but the same remarks apply in a general way to this process as to tuberculosis. Diabetes is prone to delay healing in acute middle ear suppuration if it does not actually contribute largely to its etiology. It should be suspected in all patients over 40 years of age when there is delayed recovery of suppurative processes generally, including those in the ear. Sequestration of the labyrinth as a whole or in part calls for a careful urinary examination for sugar and acetone. To treat successfully the ear condition attention must be given primarily to the diabetes.

It is needless to cite all the conditions that may contribute to chronicity in acute middle ear suppuration; suffice it to say that any disease of the kidneys, heart, lungs, gastro-intestinal tract or elsewhere which tends to depreciate the patient's health and vitality tends also to prolong acute middle ear suppuration and make it chronic; while any form of treatment directed toward the correction of these organic conditions contributes to the healing of the middle ear suppuration. Lack of vitality may exist from known causes, including some of those already mentioned; besides lack of proper hygiene, improper clothing, insufficient nourishment, etc.; furthermore, lack of vitality may result from unknown causes often inherited, general weakness due to lack of care of the mother, alcoholism in the parents, etc. The child need not be puny as an evidence of lack of vitality, for on the contrary it is sometimes fat, however, a flabby fat. Lack of vitality is also found in the feebly old.

Lack of vitality manifests itself in two ways. First, by the lack of reaction to disease, the case showing asthenic from the start. There is but slight general reaction, shown by the relative lack of fever and scarcity of symptoms. There is but slight local reaction; the swelling of the parts is but moderate and the pain insignificant; while the patient's wants are few. Nevertheless he looks sick and is sick. The tendency is for the infection to spread rapidly; it does not become circumscribed by the normal process of lymphocytosis.

Another manifestation of lack of vitality is evidenced by the manner, or rather lack of manner, in which the patient responds to treatment. Remedies aimed at stimulating the patient generally or the parts locally fail to do so, but more often have the opposite effect, when the prognosis becomes bad indeed.

Complications by way of extension of the suppurative process to neighboring parts may be a cause for delayed recovery in acute middle ear suppuration.

The most frequent extension is to the mastoid cells, with resulting mastoid abscess; less frequently to the internal ear, the lateral sinus, the dura and other membranes of the brain and the brain itself. It would take entirely too much time to discuss these various conditions in a limited paper. Nevertheless, they are important factors that deserve careful consideration and study, and should be borne in mind, if not anticipated, in all cases of delayed recovery. This calls for a searching examination, suggested in the earlier part of the paper, for by it alone are we enabled to approximate an exact diagnosis in the full sense of the term.

It may be well to mention the fact that none of the complications arise suddenly, even in those cases in which they appear to, for on the contrary we generally find prodromal symptoms of longer or shorter duration. These prodromal symptoms are generally due to a serous form of inflammation due to the action of bacterial toxins that filter through the bony partition that separates the infected area from that which is threatened. For the alert diagnostician, therefore, sufficient time is generally allowed to intercept the more dangerous suppurative form of inflammation.

Susceptibility to a particular organism, lack of immunity or failure to generate proper immune bodies in sufficient quantities may be a cause of chronic middle ear suppuration. Theoretically the vaccine treatment should be ideal for this condition. In behalf of this treatment a great deal was promised a few years ago. I almost hesitate to confess what little service the treatment has been to me. I tried it early and carefully and over a long period, and was encouraged at first, thinking I had at last found a panacea; but later disappointment came and the disappointments were repeated. Autogenous vaccines were used when the time and circumstances permitted; when they were not used the stock preparations were. When the results were apparently most brilliant with the vaccines the conditions were favorable and the same results

were duplicated in other cases in which vaccines had not been used. In the most trying cases the vaccines failed me as did other methods. There is a field for vaccines, but it is a limited one. I have not given up their use, in spite of my many failures to obtain results with them. If the preparation of the vaccines is all right, failure to obtain results would seem to show that we are not on the right track, and the cause of the chronicity must be sought in some other factors previously referred to.

My effort has been merely to outline some of the causes of delayed recovery in acute middle ear suppuration, the prompt cure of which would mean the prevention of chronic middle ear suppuration.

NONOPERATIVE TREATMENT OF OTITIS MEDIA

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Chronic suppurative otitis media is rather easily cured in a large number of cases if proper methods are adopted, but it is exceedingly difficult to obtain men with sufficient self-abnegation, one might say, to carry them out. I refer here especially to our public clinics, in which we find that assistants do not give the attention to nonoperative treatment of chronic suppurative otitis media that they should. Such work is regarded as an uninteresting grind; hence the tendency is all toward hastening these cases to the operating table.

The proper treatment depends on the location of the area of the middle ear involved, that is, whether the disease is more or less located in the tube, the cavum or the mastoid portion of the middle ear; on the stratum that is involved, that is, whether it is relatively superficial, the epithelial structures being most affected, or the tissue under the epithelium, or whether it is the periosteal layer and bone. You know the mucoperiosteum, as its name would indicate, serves two purposes, as a mucous membrane and as a periosteum, the bone beneath deriving its nutrition immediately from the mucoperiosteum. The treatment also depends on the character of the pathologic process, that is, whether it is merely a pus-producing micro-organism, being a streptococcus, staphylococcus, or one of the various forms of diplococci, whether it occurs as the result of diphtheria or scarlet fever, or of tuberculosis or syphilis.

Tubal disease is very rarely purulent. Large quantities are blown out with the catheter. Purulency in a discharge from the ear means, as a rule, disease of the bone. When the discharge from the tube is purulent, it indicates involvement of the tubal cells, a series quite separate from the mastoid system, and calls for operative intervention; obviously, not the so-called radical operation, but one outside the scope of this paper to describe. The mucus or purulent mucus comes invariably from the tissues above the periosteal layer of the mucoperiosteum. The mucus from the cavum is exceedingly scant, the moisture here being secreted by the surface epithelium; there is little or no glandular tissue in the cavum. In the tube these structures are quite evident, being more abundant at the pharyngeal opening and decreasing as the isthmus is approached, where it is absent, and again gradually increasing toward the caval opening. The perforations in the tympanic membrane from tubal disease are situated in the anterior portion of the pars tensa practically always. They are usually large in chronic cases, but may be small. They are central and never marginal in uncomplicated tubal disease, that is, an area of tympanic membrane intervenes between the perforation and the annulus. In centrifuging this discharge we find no evidence of bone cells or bone chips. This discharge may be quite abundant, may be quite fluid, is usually stringy and tenacious, but not purulent. This discharge may continue a long time, for years, more or less, with exacerbations occasionally, diminishing to a point at which the patient scarcely notices the discharge, or completely ceasing for a time. But it is chronic and continuous in many cases. The treatment should be directed to the tube. These are the cases that depend for their continuance on pathologic conditions outside of the aural structures *per se*. This has been sufficiently brought out in preceding papers. Besides removing the associated pathologic conditions in the nose and postnasal space, we should get rid of

the hyperplastic tissue in the tube itself. This may be done by application to the tube by means of the eustachian catheter, applicator, Weber-Liel catheter or syringe. Schwartze long ago recommended that in such cases the tube be syringed out. This can be done through a catheter, the irrigating fluid coming through the perforations of the tympanic membrane. We should, therefore, be careful in these cases to have a large perforation, a perforation of proper size made by the condition or artificially by surgical enlargement. The irrigating fluid we use for this purpose should be nonirritating. A normal salt solution is ideal. Nitrate of silver may be applied in these cases. A small wire, preferably not silver wire, one strand being wound about another, makes a very cheap and efficacious applicator for this purpose. A small piece of cotton is wound on the end and this is immersed in the nitrate of silver solution, and carried to the cavum. In such operations the hard rubber catheter should be employed. One should begin with a low percentage, 2.5 per cent., and increase, according to the resistance of the patient, to 10 per cent. This should be carried through the isthmus to the caval opening of the tube. We may apply the medicament to the tube by means of a syringe fitted into the catheter, but this method is less effective.

In a majority of cases, when uncomplicated by diabetes, syphilis, etc., or when the tubal cells are not involved, this will bring such a discharge to a close. In case, however, these patients do not recover, then the question comes up whether ossiculectomy is permissible, or whether we should take away a large portion of the tympanic membrane, establish a permanent opening by way of the external auditory canal, and by some method endeavor to seal up the eustachian tube and destroy the tubal cells.

Now we come to inflammations of the cavum. For descriptive purposes anatomists have divided the middle ear into the tube, the cavum and the mastoid

cells. As regards the pathology, these divisions do not hold. They are artificial, in other words. The middle ear begins with the pharyngeal opening of the eustachian tube and ends with the most remote pneumatic space of the mastoid, all being covered by a membrane of unbroken continuity. We may have these so-called superficial inflammations that do not involve the bone, but the covering of the bone, extending from the tube to the cavum, and even the mastoid cells themselves. It is a rarity to find either an acute or chronic inflammation limiting itself to any one division of the middle ear. It is in the epitympanic space that we behold the anatomic conditions which tend to perpetuate even simple inflammation, because of insufficient drainage conditions. I refer to those innumerable little pockets in the epitympanic space formed by the various ligaments that attach the malleus and incus to the surroundings, all covered with mucosa. For a long time undrained, infectious material causes the mucosa to take on the usual inflammatory changes, causing a discharge which resembles that from pure tubal disease. In a large majority of these cases the perforations will be anterior or posterior to the manubrium, and in the pars tensa.

How are we to get at these little pockets? The best way is by irrigation through the eustachian tube and through the opening in the pars tensa. This can be done by means of the epitympanic cannula. It can be done through the tube itself by the Weber-Liel catheter, a catheter made of woven silk, which is introduced through the eustachian catheter to the cavum, or to the isthmus, and the fluid forced in through the epitympanic space by means of a syringe. I do not hesitate to do this. I believe in these chronic cases the danger of forcing infectious material into the antrum is more or less, preferably more, fallacious.

Here comes in the use of the boric acid and the dry gauze drain. There was a war preceding the present war in Europe by some years, between the various

camps in Germany, Munich and Halle being the respective citadels, and it became almost as deadly as the present conflict, one camp standing for the irrigation of the ear and battling against the dry method, the other upholding the standard of the dry and bitterly militating against the wet method. Now we all know that irrigation has its place. It has its place to remove débris, to remove secretions. But we should be very careful how much we irrigate the ears in chronic otitis media suppurativa. There is no doubt that there are cases in which injudicious irrigation only perpetuates the discharge; but when we find that this is true, all we have to do is to use either a boric acid pack or a dry gauze drain. The dry gauze drain that I prefer is one made from xeroform gauze, one-half inch wide, packed against the perforation in the tympanic membrane, not pressing it, but in contact with it, and changed as often as this drain becomes moist. Or the boric acid will produce results in cases in which the dry gauze drain will not, and this is especially so in cases in which the promontory of the cavum is largely exposed, in which perhaps the malleus handle has become necrotic and disappeared, and in which the mucoperiosteum of the promontory is granular. In these cases, if the dry gauze drain does not produce dryness or a decrease of secretions, the head is bent to one side and the whole external auditory canal is tamped with boracic acid. This can be done, of course, only in cases in which the perforation in the tympanic membrane is large.

Granulation tissue in the cavum, projecting as a polyp through a perforation above or below the short process of the malleus or covering the promontory as a sodden mass, means that profound changes in the circulation of the mucoperiosteum have taken place, and that therefore the bone beneath has become more or less involved. This should be removed by snare or cautery (chromic acid, iron perchlorid, trichloracetic acid), with proper precautions. Alcohol, with or

without salicylic acid or boric acid, is a most useful application in this class of cases, as well as in small cholesteatomas of Prussak's space.

Now we come to the cases in which the mastoid is involved, and these are cases in which the bone must be taken into consideration. Here we may have perforations in the pars tensa, or most frequently in Shrapnell's membrane; these are usually situated at the periphery of the tympanic membrane. These are usually cases of cholesteatoma produced by the overgrowing of the epithelium from the auditory canal into the epitympanic space, which causes pressure, and this pressure causes destruction of the bone within the antrum and mastoid. This is not a condition which necessarily demands operation. It is our duty to ascertain the extent of the disease. I have cured numerous cases of this kind, when small and not too old, by the use of the epitympanic cannula and alcohol. This epitympanic cannula is inserted through the perforation of the epitympanic space, or in case there is a fistula, posterior or anterior, and that is washed out, and frequently I wash out large masses of cholesteatoma. After this I either pack with boracic acid or dry gauze.

How do we know the mastoid is involved? By the history of the patient, as to whether there have been symptoms of spontaneous pain or tenderness on pressure, of swelling back of the mastoid at the beginning of the otitis media; as to whether the discharge produced is purulent; as to whether the perforation is situated in the pars tensa or pars flaccida; by the skiagraph; by the recovery of cholesteatomatous tissue from the washings; by the presence of cholesterol crystals and bone plaques in the centrifugalized pus; by the presence of symptoms indicating meningeal or labyrinthine irritation. Certain groupings of these symptoms indicate radical operative procedures, but this subject cannot be even touched on in this paper.

I have just two more points: first, as to suction. That has been tried a great deal. Personally, I have seen very little good come from it. I do not believe, however, that it does harm or that it may be dangerous. It should certainly be tried if any one would like to try it. In one sphere it is especially useful, and that is in diagnosis as to the region whence comes the pus.

Second, as to vaccines: I have seen only one kind of case of chronic suppurative inflammation in the middle ear benefited by vaccines, and that was a case in which the epitympanic space was involved, characterized by a considerable discharge of mucus, and here we have found in two cases a pure culture, in one staphylococcus and in the other staphylococcus was greatly in excess of the other kinds of bacteria. Here the autogenous vaccine produced a cure in a little over two weeks in one patient who had been under treatment for as many months.

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THE END-RESULTS OF TREATMENT OF CHRONIC SUPPURATIVE OTITIS MEDIA

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The end-results of treatment naturally fall under two heads, namely, the nonoperative and the operative.

In nonoperative cases the results depend much on the correctness of the diagnosis. In any case that is, in fact, a nonoperative one, the end-result should always be a cure of the discharge and improvement of function, provided the cause of the aural discharge is not a constitutional one, such as syphilis or tuberculosis, and there is no labyrinthic involvement present. Many cases that are properly classified as nonoperative in so far as concerns the ear are, nevertheless, operative in the sense that the environment of the ear is bad, so bad indeed that operative measures for the improvement of nasal breathing are necessary. In such as these the end-results of treatment depend much on surgical means for the removal of infectious foci of the nose, nasopharynx or pharynx.

We may, therefore, dismiss the nonsurgical aural cases with the statement that when assured that any given one is actually in the nonsurgical class, cure should in the vast majority of cases be expected, and the hearing power should usually be improved.

The end-results of the surgical treatment of chronic suppurative otitis media depend on many things.

1. The age of the patient: This, in my own experience, has had little to do with the outcome of surgical treatment, further than that the radical measures necessary to cure are somewhat more difficult in chil-

dren than in adults, and the after-treatment usually can not be so thorough with crying children as with older patients. However, in cases of children in whom the aural disease or its treatment are not modified in any way by the conditions I shall shortly mention, I have found the end-results satisfactory in a high percentage of cases.

2. The condition of the nose, nasopharynx and pharynx: The end-results of surgical measures for the cure of chronic otorrhea are often failures to a great extent if the diseased environment of the ear is not corrected. This fact is now generally accepted, I believe, by aural surgeons, for if, as believed, the nasal and nasopharyngeal diseases were the chief predisposing factor in the causation of the chronic aural affection, then cure of the aural disease must be unlikely so long as the diseased environment remains. Clinical experience in the treatment of chronic running ears bears out entirely the correctness of this belief.

3. The nature and violence of the original aural infection: These probably more than any other factors determine the end results of surgical treatment. If the bacteria of invasion were violent of action, as is usually the case in the infectious diseases of childhood or in the severe epidemics of grip and as a result serious invasion of the osseous walls of the drum cavity or of the deeper portions of the adjacent mastoid or petrous parts of the temporal bone occurred, the nature of the final outcome may be in doubt; however, the end-result of surgical treatment will even then usually be a cure, but may possibly be only a partial cure and sometimes is a failure. While of course the proportion of cures, partial cures and failures depends much on the conditions present in the patient, as set forth in the points of argument to follow, much depends on the skill of the surgeon at the time of the operation, and on his energy in following the case personally a sufficiently long time afterward.

4. The presence of complications at the time surgical measures are attempted: The end-results of surgical treatment of chronic aural affections, when complicated by extension of the infective processes to the labyrinth, meninges or lateral sinus, furnish a brilliant example of the progress and efficiency of aural surgery. The end-result of course here depends very much on early diagnosis, since success in this class of surgery goes hand in hand with prompt diagnosis, which alone gives the surgeon his essential opportunity. Increased knowledge on the part of the internist concerning the possibilities that may arise from a chronic aural discharge and the greatly increased facilities to early diagnosis of aural complications now at hand, when taken together with a better surgical knowledge on the part of the aurist than ever before existed, furnish the reason for the many brilliant cures that have been reported as a result of surgical measures for the relief of brain abscess and sinus thrombosis. About 50 per cent. of these patients are now cured, whereas formerly 1 per cent. was regarded high. The present percentage of cure will no doubt be raised when internists and others have greater solicitude for those patients who have chronic aural discharge. Earlier diagnosis in a larger percentage of cases will then be made, and of course earlier operative opportunities will be presented.

The weakest spot in surgical otology today is the end-result of meningitis, especially leptomeningitis, as a complication of suppurative otitis media, since practically all patients now die, whether operated on or not. Some encouragement has been offered from operative methods and subdural drainage, especially by Crockett, who recently reported three cases of cure from this plan; but the majority of operators have not reported anything but failure. The chief end-result at present, in so far as concerns meningitis, is prevention, and there can be no doubt but that all who operate for chronic suppurative otitis media according to the most

approved technic frequently prevent this dangerous intracranial complication; hence it is evident that the end-results from treatment, especially the curative end-results, often depend on:

5. The period of the disease in which the operative attempt to cure is made: Largely, no doubt due to the facts that a chronic aural discharge is not often painful, and to the tradition that it may be helpful to the system, operative measures are not considered by the patient until danger signals have arisen which are clearly evident to the experienced aurist. The nature of the end-results are often reversed by the delay, for results prove that radical mastoid surgery performed for the cure of a running ear, if done at a selected time, and before there is present any extension to some vital center, is among the safest surgical procedures, and also that when performed by those especially trained and experienced in this class of surgery, the cure of this discharge should be expected in the vast majority of such cases. The end-results at present are therefore, not so good as they should be. The fault lies with both the physician and patient. The physician who should know the dangers resulting from delay should reeducate the public concerning the actual dangers due to prolonged aural suppuration. Considerable knowledge about discharging ears existed centuries before disease of the appendix was known, yet today both physician and laity know vastly more of the diseases and dangers lurking about the appendix than about the equally common and equally dangerous chronic suppuration of the middle ear. The only conclusion one can draw is that the abdominal surgeon has gone to greater pains to enlighten the public than has the otologist.

6. The physical condition of the patient: No argument is needed to prove that the end-result from the surgical treatment of chronic otorrhea depends much on the physical condition of the patient. Conditions of ill health may be due to bad environment, overwork,

undernourishment, chronic malaria, septic states due to the ear itself, or other foci of infection. Most of these and others can usually be sufficiently overcome, in preliminary treatment, to insure a satisfactory end-result. Likewise, when syphilitic, the condition of the patient may be so cleared that satisfactory aural treatment may be instituted. Unfortunately, however, tuberculosis, either general or local, is often present in these cases, and the outcome usually is failure to cure.

7. The skill and judgment of the operator: While of course these attributes are necessary to the success of any class of surgery, they are especially essential in the performance of the bone surgery necessary to the cure of necrosing osseous tissue which lies in the midst of important and somewhat dangerous structures, the semicircular canals, facial nerve, lateral sinus and brain coverings. Overoperating incurs great risk of injury to one or more of these structures, while timidity on the part of the surgeon is pretty certain to result in failure to cure, because of failure to remove all the disease.

The nature of the end-result, whether cure or failure, frequently depends on the efficiency of the after-treatment of the patient following surgical means of cure. The most satisfactory end-results are secured when the surgeon who operates gives personal attention to the after-care until the wound is dermatized, and healing is assured. Failure is a not infrequent termination in patients, even though thoroughly well operated on, if afterward they are assigned to the care of physicians not especially trained in the management of this class of surgery. I have the personal feeling that my work is only well begun when a radical mastoid operation is performed and that it is quite as much a duty to note the entire after-progress as to operate.

The nature of the end-result often depends much on the patient himself, for sometimes as soon as he is able to leave the hospital, and when the external

wound is healed, he acts on the belief that all has been done in the way of treatment that should be done, and therefore neglects to return for further observation or necessary care. I have seen many examples of total failure due to such neglect following the most skilful operations. On the other hand, I have observed many successful endings in cases that, during the first few weeks or even months following operative measures, were most unpromising, the final cure being obtained, I believe, by persistent, well-directed after-attention. While the foregoing points determine in large measure the end-results of treatment, the results themselves may be considered.

As to the effect on the hearing: This, in the bona fide nonsurgical cases in which there is no labyrinthic involvement, is usually favorable, since there is frequently much improvement in function and seldom actual loss above that already present. Following surgical treatment, especially following the radical mastoid operation, there has been, in my experience, usually a retention of the same degree of hearing as before the operation. Occasionally I have observed some loss of function, and I think quite as often there has been slight gain. Great improvement of function should not be expected as an end-result of surgical treatment. The prime object of such treatment is to conserve life, and improvement of hearing should usually not be promised. I am aware that a few American aurists make claim of almost invariable marked functional improvement following their own technic of operation, but I believe this claim is not made by the majority of aural surgeons.

As to cure of the suppuration: In strictly nonsurgical cases ultimate cure may be expected. In patients operated on in a more or less radical way ultimate cessation of the discharge and dermatization of the operation wound will follow in 90 per cent. of cases, provided the hospital facilities are modern in every respect, the surgeon is well experienced, and the

after-care of the wound is given by one skilled in the healing of this class of wounds. This estimate is, of course, exclusive of tubercular cases.

As to the mortality of the patient: Nonsurgical aural discharge, while it remains nonsurgical in its nature, probably never ends disastrously to the patient. When bone necrosis occurs, and when the case is therefore a surgical one, danger to the life of the patient is present in each case and at all periods of the progress of the disease. Proper surgical treatment does not add to that danger, but on the contrary is the best-known means of avoiding a fatal result. Radical surgery of the temporal bone, performed for the purpose of curing chronic aural discharge, is of itself remarkably free from danger to life. In a record of about 300 radical mastoid operations I do not recall death in a single instance that could be attributed to the operation. The real danger to life arises in neglected cases of chronic aural discharge, when the disease has already approached or actually attacked some vital spot. The radical mastoid operation may therefore be regarded as especially free from danger to life in all cases in which it is employed before the meninges or sigmoid sinus has been attacked by the aural suppuration.

Any discussion of the end-results of treatment of chronic aural suppuration would not be complete without mention of the fact that rarely the dura is uncovered accidentally during operative procedures, the sinus may be lacerated and the facial nerve may be exposed or severed. Accidental exposure of the dura or penetration of the sigmoid sinus are of little or no consequence if the wound is left clean and the accidental injuries are properly dressed and managed. Injury to the facial nerve is of course a serious accident, and one much regretted, but it should always be remembered that Nature, through the necrosing processes incident to the chronic otorrhea, produces many more facial palsies than does the experienced, careful surgeon-otologist.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRs. MACKENZIE, PIERCE AND BARNHILL

DR. FRANCIS P. EMERSON, Boston: Whether we have a chronic suppurative middle ear or an acute suppurative middle ear, the first essential is drainage through the membrani tympani, drainage which implies a sufficient opening, with the removal of granulations or anything that blocks the free flow of pus. After that has been established certain primary conditions of the eustachian tube, dwelt on by Drs. Pierce and Mackenzie, will have to be considered. They are fundamental. In a rational consideration of this subject we must have in mind some conception of the way in which this infection becomes chronic, and the methods which would be employed to clear it up. One of the very early conditions is that connected with imperfect ventilation of the nasal pharynx, which is caused by the septum. With a badly deflected septum there is either a compensatory hypertrophy of the middle or inferior turbinal. This is followed by an increased function and hypertrophy. The hypertrophy causes imperfect ventilation and imperfect drainage. This latter is followed by a low grade infection which is constant and persistent and a source of reinfection of the eustachian tube. A little later comes a more virulent infection, and this is followed by sinusitis. Any preventive measure must take into consideration all of these factors—ventilation, drainage, reinfection. In certain cases of mastoiditis in children it is impossible to heal that mastoid until we remove the adenoids. The primary cause of this middle ear trouble was an acute infection in the nasopharynx, and because the connection is not more evident when these cases come to us as chronic cases does not imply that the primary focus is not still active. Any conservative treatment must take into consideration the remedying of these conditions which cause reinfection. These infections that have their focus in the sinuses extend to the epipharynx, to the eustachian tube, and later to the middle ear, so that a conservative treatment of the middle ear suppuration implies straightening of the septum and trimming the turbinates. You must also cure the epipharyngitis, which is often a very active cause in keeping up an irritation in the tube.

Another point is that the eustachian tube on the side of the middle ear which is most involved, is always the one most open. If you catheterize the eustachian tube you will find that to a certain extent it has lost its power of contraction and that the condition is often made worse by auto-inflation by the patients themselves.

After you have relieved the primary foci and the resulting infection, and established drainage of the middle ear, many patients will get well without further treatment. All the other measures that are applied directly to the middle ear come in as a part of the secondary treatment.

DR. W. EUGENE DIXON, Oklahoma City: I was very much interested in Dr. Pierce's remarks on otitis media, especially on the tubal treatment, but I wonder how many here find difficulty in using the No. 1 wire with cotton on the end passed through the catheter as a guide into the eustachian tube. I cannot get through the isthmus of the tube as easily as the doctor says he can. I want to present a technic for passing cotton wound applicators, bougies, electrodes or syringes, into the eustachian tube by the direct method without using the catheter as a guide. Wind the cotton very thinly, but securely, around the applicator from the tip to one-half inch above the bend. Dip it into cocaine, to cocaineize the mucous membrane. Into one nostril pass the Holmes naso-pharyngoscope. Adjust it so that the upper one half of the mouth of the tube is in plain view. Into the other nostril pass the cotton wound applicator in such a way that the tip of the applicator is on the floor of the nose. Looking into the scope you can see it as it emerges into the nasopharynx. Carry it outward, and backward into the mouth of the tube in a vertical direction, and remembering the anatomy places the tip on or near the floor of the tube, rotate the applicator or syringe tip outward, upward and backward, all the time keeping the instrument after its rotation in the upper part of the tube, or between the anterior and posterior plates of the upper portion. It is very easily done.

DR. CULLEN F. WELTY, San Francisco: Dr. Pierce said that chronic suppurative of the middle ear is easily treated and that a cure results in a majority of cases—if the proper treatment is given. This is a most remarkable statement coming from a man so prominent. I have tried for weeks and months to do the various procedures that have been described, with little or no results. Patients come back in two or three weeks or months with a discharge from the ear again. The number of cases cured by treatment as number cured by operative procedures, is almost infinitesimal. Dr. Pierce also says that he cures cholesteatoma by irrigating the middle ear, which is absolutely ridiculous. It cannot be done as he well knows.

He also states that if there is mastoid involvement; these cases are not so likely to get well. How do you know whether there is mastoid involvement? He says: If there has been pain or tenderness back of the ear. I challenge anybody who makes such a statement as that. People may know whether they have had pain or tenderness back of the ear, but you cannot say there is mastoid involvement because of any such symptoms as the pain and tenderness may be produced by tooth root abscess—imbedded teeth or a buried tonsil. I have had to contend with all these and many more. I wish to say furthermore, that in the radical mastoid operation a large percentage—90 per cent.—of the cases have large lesions within the mastoid cells, lesions that could be seen at

from 10 to 15 feet. If we are confronted with such statements as Dr. Pierce has made, somebody must have the courage of his convictions and get up and explain why this is not just as stated. Dr. Pierce speaks of tuberculosis—that these cases do not get well, so what is the use of operating? The only treatment for a tubercular ear is to operate thoroughly, and if you operate thoroughly you will cure them. I have such cases on record.

DR. EMMETT L. JONES, Cumberland, Md.: For many years I have treated my cases by a method which is very simple. I described it two years ago. I believe all ear infections originate in or travel through the rhinopharynx, and if we are to treat them successfully we must begin with the rhinopharynx. If we do that we will have nearly 100 cures in 100 cases. With this method the hearing is always restored, the perforations heal, the discharge ceases, and there are no mastoid symptoms. Cases which have had several days purulent mastoid symptoms according to all accepted standards, following this treatment get well, and even some chronic cases get well. The basis of the treatment is the daily application to the rhinopharynx of a strong solution of phenol, tincture of iodine and glycerin, from which you have the reaction of a bad sore throat. Then in acute cases I dip the tip of a tampon in a solution of epinephrin in anilin oil, 1 to 1,000, with 10 per cent. of cocaine added, and apply that frequently to the drum membrane. In a few hours the pain eases, the discharge soon amounts to nothing, and the trouble in the mastoid gets well, and there is absolute restoration of hearing.

DR. J. HOLINGER, Chicago: The main part of Dr. Beck's paper is his pathology. Pathology of chronic suppuration of the middle-ear has not been given, and therefore we will not and cannot come to an agreement on how to treat it. If we have a carefully worked out pathology, the indications will become evident, and then we might agree; but this way we cannot.

DR. A. E. PRINCE, Springfield, Ill.: I want to direct attention to a simple method of securing a partial vacuum in cases of incipient mastoiditis. Every acute inflammation of the middle-ear should be considered in its relation to the antrum and mastoid cells which are usually involved. The establishment of a partial vacuum in a large percentage of acute cases, and in some subsequent cases, will prevent the extension of the disease and bring about a cure. Dr. Baum carried through a series of cases which were recommended for mastoid operation, by the use of Beer's vacuum method, and cured 80 per cent. without an operation. The method I recommend is much simpler. It consists of instructing a mother or nurse to use the flaring end of a soft catheter which is selected to fit the external meatus. By sucking with

the mouth at frequent intervals the patient is relieved, and the disease is prevented from extending to the deeper cells; an operation is avoided in a considerable number of cases. If the patient be mature he can do this himself. He will know when it hurts and avoid excessive suction. This is applicable after every paracentesis and every spontaneous rupture of the drum membrane. It does not apply to cases of chronic suppuration, but to recent cases.

DR. OLIVER TYDINGS, Chicago: The causes which brought into existence suppurative otitis media, if left uncorrected, are sufficient to keep it going to the end of time. I wish to endorse the tube introduced by Dr. Prince. I have used that treatment for a number of years. It was not original with me; I do not know where it came from. I am sorry to disagree with Dr. Pierce on cholesteatoma. I believe that cholesteatoma has a separate and distinct etiology—and this in spite of no less an authority than Politzer. My own experience is at variance with his, and proves conclusively to my mind that it is due to a separate and distinct entity from the cause of suppurative otitis media, and must be treated by separate and distinct methods of treatment. I have used the same catheter Dr. Pierce used; I have washed out the tympanic cavity until I was tired and the patient's endurance exhausted—and although I have not reached the degree of efficiency in the use of the catheter that Dr. Pierce has—and while I was doing that work patiently, and sometimes had an erosion of the semicircular canal with the resulting disturbance of equilibrium, showing that with all my washing, I still got enough accumulation there to appall me, so I quit washing out and I have not washed an ear for this malady for some time. The only thing I do or advise for cholesteatoma is to operate, and the sooner done the better. In regard to vaccines: I have found them useful in some cases and have gotten some very beautiful results with the mixed vaccine.

DR. HARRY B. HARRIS, Dayton, Ohio: It strikes me that Dr. Dixon's applicators are too stiff to pass through the eustachian tube without doing injury. The applicators I am using and have used in several hundreds of cases are those of Dr. Yankauer. I do not recall any case where I was unable to pass the applicator through the isthmus and make my application as desired. These applicators are made of very delicate wire, bent back and twisted on itself which makes it double, leaving a very small loop at the end where the cotton is applied. It is impossible for the cotton to come off of this end if properly put on, and the applicators are so flexible that they easily mold themselves to the shape of the tube without undue force.

DR. W. EUGENE DIXON, Oklahoma City: I have been using these applicators since 1910, and never once in that length of

time has the cotton come off. The cotton is wound not only on the end, but clear back of the bend and therefore it is always in sight. If it did come off all you would have to do would be to pull it out with a pair of forceps through the nose, as the bend of the instrument which is covered with cotton is not in the eustachian tube and therefore the cotton would be left hanging in the nasopharynx. The new applicators are threaded on the end for some distance which holds the cotton very securely, in fact so secure that it is very difficult to remove it after the use of the applicator. As far as injuring the tube is concerned, the cotton wound applicator can be passed just as gently as a catheter can be passed into the urethra. It is held in one hand and passed while with the other you hold the nasopharyngoscope, and see just what you are doing in every step of the operation. The sense of touch is acute and one can very readily develop a technic without doing harm.

DR. WILLIAM S. TOMLIN, Indianapolis: As to tuberculosis of the middle ear, having had some experience as consultant in the treatment of tuberculosis, for a sanatorium a considerable number of these have come under my care. Of most importance in their treatment is the local application of tuberculin emulsion. We start usually with the dilution No. 1 or No. 2, and gradually increase it. Our experience has been very favorable in the local treatment of these cases where the opening into the drum was sufficiently large to make a successful application. In some cases I have tried to introduce it through the eustachian tube, but that has not been successful when the opening into the drum was not large. These cases require especial attention when tuberculosis develops in the throat. Tubercular infection of the middle ear may be said to be almost always derived by way of the eustachian tube. I am also of the opinion that the primary causes which have influenced the development of infection of the middle ear must be removed if we expect them to recover with nonoperative treatment, and in many cases even with operative treatment the ear will continue moist, giving rise to recurrences, if you do not remove the cause. In some cases where I have not been able to find adenoids, teeth, infected tonsils or indications of the source of infection, the treatment of the lower end of the eustachian tube has brought about results. In these cases I have found the patients would state that they had noticed when attempting to blow the nose in the ordinary way, without any extraordinary force, they would constantly hear the blowing of the air into the middle ear.

DR. CHARLES M. ROBERTSON, Chicago: I have been waiting to hear some one raise the point of diagnosis of perforation of the tympanic membrane. In chronic suppuration of the middle ear if the discharge consists of mucus from the

eustachian tube, there is no use putting on suction; there is no use putting medicine in the ear, there is no use in lavage. If the patient wishes to clear the tube he can do it by blowing the air through from the pharynx. In case of suppurative disease of the ear per se, if the discharge is coming down from the attic, there is no use to wash by cannula as the case requires operative treatment. In regard to perforations, we divide them into innocent and dangerous. If it is a dangerous perforation there is no use in trying anything else but an operation. When the opening in the drum membrane is large anteriorly and of innocent type the case is usually tubal and the tube should be destroyed. With the perforation in Shrapnell's membrane, there is no use to expect results by topical treatment, the opening should be enlarged to promote drainage and if this is not sufficient to produce cessation of discharge the case should be operated on by a complete exenteration. I use the gauze treatment in the last part of a suppurative discharge in acute cases and it has done very well in suppurations of this type. In all of these chronic cases a radical mastoid operation should be performed.

DR. CLARK W. HAWLEY, Chicago: I do not know how to treat suppurating ears. This man says do this, and that one says do that. I say it depends on the symptoms in each case. In acute suppurating ears do not use water. I use absolutely no water; I have not washed a suppurating ear for twenty years. I simply put a piece of cotton on a small toothpick and pass that into the ear until I get it clean.

DR. GEORGE W. MACKENZIE, Philadelphia: We should anticipate complications before they arise. In the first place, any acute middle ear suppuration which endures for more than six weeks is complicated. There is something that is delaying recovery, and it is for us with what knowledge we possess of the pathology of middle ear suppuration to determine what is at fault and whether there is a single factor or multiple factors. By a thorough examination one is often made aware of complications before the patient complains of symptoms suggesting them. Nine or ten years ago I examined a series of 117 cases of cholesteatoma. They were examined before operation and a diagnosis of cholesteatoma was made in every case by a microscopic examination of the washings from the ears. The results of these examinations were published. The secretion of little, flaky particles that come out of the ear when washed, is put under the microscope in its natural state and examined for micro-organisms and crystals. The crystals are rhomboidal in shape, many with a corner broken off. When cholesterin crystals are found, the patient has a cholesteatoma. Out of 117 cases that were operated radically the operation substantiated the diagnosis made by the microscope prior to operation. Furthermore, there was not a single case of cholesteatoma that had not

one or more complications, which, I think, is the strongest argument in favor of operating all cases with cholesteatoma. We run too much risk by trusting to conservative methods.

DR. NORVAL H. PIERCE, Chicago: My brief remarks were for the purpose of calling attention to my views regarding chronic suppurative otitis media, and I endeavored to show that chronic suppurative otitis media is not a simple matter. It is not an entity. A discharge from the ear is only a symptom of a very complicated pathology involving a very complicated organ. I think I do as many radical mastoid operations as any gentleman present. I do not hesitate to do a radical mastoid operation. But I think that the man who on seeing a chronic discharge from the ear says that the only possible treatment for it is a radical mastoid operation is devoid of proper education or is a fanatic. I regard cholesteatoma as it involves the ear as a very dangerous condition, one that most frequently calls for proper radical treatment. I have cured cholesteatomatous conditions of the middle ear by other means than the radical operation, and have retained for the patient a sound conducting apparatus that has a very much better function than the sound conducting apparatus of a patient who has been operated by the radical method after four or five years. I am not disparaging radical work. I am hoping that you will not regard the suppurative ear as an indication, and unequivocal indication, for radical work. Dr. Dixon drew attention to his applicators for the eustachian tube. The eustachian tube is not a straight tube; it is a tube that has more or less of an angle at the isthmus, and I cannot see how he can drive that straight inflexible staff up a tube that has an acute angle. That is the reason I use a very flexible silver applicator. There are tubes through which we cannot push even this very flexible applicator because of the acuteness of the tubal angle. Regarding the strictures of the tube. Schwartz en a very long time ago investigated on the dead body the frequency with which organic strictures of the tube occur, and his report was to the effect that in simple inflammatory conditions, strictures of the tube practically never occurred. They occur as the result of diphtheria, syphilis, and some other diseases, but then the strictures are situated at the pharyngeal end of the tube, and according to his report there was never a stricture at the isthmus. The reason men think the tube is very frequently the site of stricture is because the probe, or bougie, or applicator is arrested at the acute angle. I am sorry to think that any gentleman in this section would criticize a remark that I might make here as absurd and ridiculous. I have given this question of otology the best part of my life. I have tried to analyze cases, having ample opportunity and material to reach certain conclusions, and I say now, that if we do not treat these chronic suppurative inflammations in an intelligent manner, if we resort imme-

diately to the destructive—because it is destructive—radical procedure; if we do not attempt to bring about a cure in these cases that present no symptoms of rapid advancement, of cerebral or other complications, then we are not doing our duty to our patients and are undoubtedly rendering ourselves liable to the very ignominious appellation of plain, ordinary, common or garden variety of butcher.

DR. JOHN F. BARNHILL, Indianapolis: Some remarks were made that it seems to me ought to be corrected. The question is the problem we must meet in the chronic discharging ear. Each patient is a problem. If the problem is a simple one, if, as Dr. Pierce has said, the whole trouble is in the eustachian tube, clearly the problem is one of the eustachian tube and not of a mastoid operation. If the trouble is in the environment of the ear, if there is a bad state of ventilation, if it is the epipharynx that is involved, then the problem should be attacked from that angle. One gentleman says that 100 per cent. of his cases were cured by his treatment of the epipharynx. I believe these were acute cases and therefore do not fall within the line of our discussion. I think everyone recognizes the value, ordinarily, of treatment of the epipharynx, but to allow a statement such as Dr. Jones made, that 100 per cent. of cases were cured by this treatment, to go unchallenged, would be wrong. Now I think we have seen cases in which we have not had any time to make any application to the nasopharynx. There is often a mastoiditis almost as soon as there is a middle-ear disease, and it does not stand to reason that we could cure that kind of mastoiditis by local application to the nasopharynx. If there is necrosed bone, and if reasonable local treatment has been given, I think Dr. Pierce will agree with me that if the suppuration continues some kind of surgery is necessary, and that radical mastoid surgery is best. If there is cholesteatoma present, I think that not 95 per cent. but 99 per cent. of these cases are cases for the radical mastoid operation. So many of them are complicated. Suppuration from the ear means that something is rotting. Pus is the product of decay, and if something is decaying and the decay continues long enough it will get into the meninges, the sinuses and the labyrinth, or some other dangerous place. It is not wise to stand by indefinitely and allow a chronic suppuration to go on without warning our patients that an operation, after reasonable treatment, is the best and safest procedure.

DR. J. HOLINGER, Chicago: I would like to caution against the use of aniline oil. I have seen serious symptoms of poisoning develop after a few drops of the oil were poured in the ear. It was a case of acute otitis media without perforation, and while it was not fatal, it kept me in hot water for a whole night. I never shall use aniline oil in the ear under any condition.

THE MASTOID OPERATION OF TEN YEARS AGO AND OF TODAY

BRIEF ESTIMATE OF THE ADVANCE AS MEASURED BY PRACTICAL RESULTS

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Whatever changes have occurred during the past decade in our method of operating have involved chiefly the treatment of the flaps or soft parts. When men differ as to technic they differ usually in advocating either the old wide-open, gauze-packed wounds, with which we are all familiar, or some form of closed or partially closed wound.

Undoubtedly a growing respect for the soft parts in mastoid surgery has led to some modifications of surgical method. I shall try to show that these changes have not been haphazard, but rather the logical outgrowth of a better appreciation of laws governing wound repair.

The Bone Operation.—With minor differences to be noted later, the bone operation of ten years ago was practically that in use today. Posterior drainage from the vault and thorough removal of diseased bone in whatever direction and to whatever distance this might lead, were then, as now, recognized as the chief surgical aims. Complete obliteration of the mastoid cells and removal of the mastoid tip formed part of the prescribed technic. Removal of the diploic tissue or intercellular bone structures from the zygomatic region was recognized in theory, but in practice not so generally or so thoroughly carried out as in the operation of today. The necessity for removing all overhanging ledges of bone from the margins of the

bony wound was insisted on by all competent surgeons. In fact, the dislike for sharp and angular bone margins led often to removal of bone posteriorly considerably beyond the limit of the diseased area, this giving rise to exceedingly extensive bone excavations. In skilful hands this operation, thus completed, left a large cavity walled by smooth and apparently healthy bone.

Treatment of Soft Parts.—The wound at completion was flushed with sterile salt solution, dried, and then packed with iodoform or sterile gauze. Beginning at the aditus, gauze strips were pressed firmly into every portion of the bone cavity, and were used in such liberal quantity as to project well above the wound level. The soft parts were thus held widely separated, the posterior flap being pressed well back to the posterior margin of the extensive bone excavation.

Subsequent Dressings.—While the outer dressings were commonly changed within twenty-four hours, the wound packing was usually not removed until the fifth day after the operation. When first removed, it was not uncommon to find a perfectly clean wound surface of practically bare bone. Not infrequently the appearance of the bone cavity at the first change of dressing was identical with that seen at the completion of the operation, with perhaps here and there a bare trace of beginning granulations. This in the absence of fluid pus was generally regarded as a favorable condition. Should pus or serum have collected at any point between the bone and gauze, it was wiped away. The wound was then repacked in precisely the same fashion as the first dressing, except perhaps that slightly less pressure was employed. These, or similar dressings, changed on alternate days, constituted from this stage the routine of treatment.

Results.—Generally speaking, the results obtained were fairly good and it may be stated that in a majority of cases recovery with complete elimination of the

suppurative process took place. As offsetting this fact must be mentioned certain recurring mishaps, which seem to have been in some degree attributable to the method in use:

1. In a fairly large percentage of ultimately successful cases, healing was unduly delayed, a lapse of ten or twelve weeks or longer between operation and final healing being by no means uncommon.

2. In a portion of the cases, certainly much larger than is met with today, secondary operation for removal of diseased bone was necessary.

3. In a rather large percentage of cases final healing, usually considerably delayed, occurred with the formation of a permanent and unsightly depression of variable depth occupying the site of the operative bone cavity. This unfortunate deformity is exceedingly rare today.

4. In a considerable, and formerly puzzling, percentage of cases healing in an apparently healthy wound was delayed, sometimes indefinitely or to the point calling for secondary operation, by persistent failure of the aditus to close. This, again, so far as I know, is a rare obstacle to healing in the mastoid operations of today.

The above represent perfectly well-defined post-operative conditions which most experienced surgeons have met with. That they occur less frequently today than formerly suggests a relation of cause and effect. I personally believe that no discussion of an established operation is of the least value which has not some practical aim in view. In this sense, the most useful discussion would take the form of an attempted analysis of the occasional causes of failure. With this purpose, I shall limit my discussion strictly to the following headlines: (1) surgical treatment of the aditus, (2) surgical injuries to bone, (3) influence of pressure on tissue repair, (4) drainage versus tight packing in mastoid surgery, (5) treatment of the soft parts.

Treatment of the Aditus.—A stage of the simple mastoid operation in regard to which there is as yet no uniformity of practice is the treatment of the aditus. Formerly the simple establishment of drainage was by many considered all that is required, and there are surgeons who still hold and maintain this view. It seems to me that a rational view on this point might be stated as follows: In very recent cases, in which persistent pain or severity of symptoms compel early operation, little treatment of the aditus may be necessary. Why curet the aditus if lined by an intact, though swollen, mucosa, easily capable of a return to normal?

Usually, however, the tympanic lesion sufficiently antedates mastoid symptoms to make this region a seat of advanced pathologic change. Generally the mucosa is eroded and partly replaced by exuberant granulations. If these granulations are only partially removed from the aditus, what remains may shrink and the parts rapidly regain their normal character. On the other hand, a small amount of granulation tissue left in this situation may mark the site of a focus of disease in the underlying bone. Such a focus of disease, if not surgically removed, may perpetuate the tympanic lesion. There is no question that many trying cases of delayed repair and some failures have been due to this cause.

Granulations attached to the roof and posterior wall of the aditus may be quickly and radically dealt with. Frequently a considerable mass of diploic tissue is attached to the tegmen tympani, thorough removal of which provides a much safer postoperative condition.

Granulations occupying the floor of the aditus are frequently attached also to the short process and body of the incus, and greater care is necessary in order to avoid dislocation and even extraction of the incus. Particularly in operating on young children is this danger a real one. Removal of granulations in this

situation often brings the incus into view, and sometimes also the head of the malleus. In cases of long-standing tympanic suppuration, which have not reached the stage characterized as chronic suppuration, exposure of one or both ossicles by careful removal of the outer wall of the vault may be necessary in order to bring the vault into a condition favorable to prompt tympanic resolution. This, however, is exceptional. The contention of some surgeons that the incus should be exposed to view as a routine practice in all mastoid operations does not appeal to me as sound.

Surgical Injuries to Bone.—In regard to general technic of the bone operation, I would like to refer to one point only. Aural surgeons have been particularly slow to see the possible danger of excessive planing or scraping of bone surfaces in mastoid surgery. If the inner plates, either by intent or accident, are actually removed over any considerable area, the underlying dura through its abundant blood supply invariably and almost immediately inaugurates the formation of granulations which are the foundation of tissue repair. Who has not exposed an area of dura over tegmen or covering the sinus and within a few days seen this membrane absolutely hidden by a layer of healthy granulations? On the other hand, if the boundary plate in any part of the mastoid cavity is scraped or reduced to an extent injurious to its vitality, the process of repair is either retarded or actually fails. Theoretically, excessive scraping of the bone may act injuriously in two ways, namely, either by insult to the minute blood vessels within the bone, as a result of which repair is retarded until the vascular supply is reestablished; or by reduction to a point actually destructive to bone vitality. Thus we may have only a superficial or surface necrosis, which later is thrown off in the discharge; or the injury may involve the entire thickness of the bone. I have seen cases in which, after a puzzling period of delayed

repair, the bony covering of the sigmoid sinus has come away almost as a sequestrum, thus paving the way for normal repair.

When we have defined roughly but clearly the confines of our mastoid cavity, that is, have revealed in contour its various limiting plates, we shall do well to avoid overtreatment of these surfaces. For example, when we have removed in bulk the cells attached to the bony covering of the sigmoid sinus, we see at first in the inequalities of this surface the outlines of the cells, now opened, lying nearest to this plate. With a curet we may easily display our skill in reducing this surface to one of even and polished smoothness. But in doing so we may seriously impair its health and vitality. This, of course, applies equally to other limiting plates of the mastoid cavity. I am convinced that many an operator has blamed himself in cases requiring secondary operation for failure to remove all diseased bone, when in reality he had erred in the opposite direction, that is, in reducing the bone in certain regions to a degree destructive to its vitality.

There are two causes for excessive curetting of bone surfaces in mastoid surgery, namely, (1) the surgeon's fear of overlooking a series of deeper cells still uncovered; and (2) a more or less general impression among aural surgeons that a smooth and even surface is per se a condition favorable to repair. I know of no evidence in support of this view. If the bone is healthy it may, and often does, withstand this treatment, but repair is retarded. If diseased, it is safer to leave uncovered dura than dura covered by diseased bone or bone which has been scraped to a degree leaving its vitality in doubt.

Influence of Pressure on Tissue Repair.—If in mastoid surgery the bone has sometimes received harsh treatment, the blood supply has received even less consideration. It must be remembered that in the old open-wound method of treatment, the sole source of blood supply necessary to tissue repair was the bone

itself. In addition to the loss of its supporting periosteum, to the occasional injury to bone vessels through excessive use of curets, the bone cavity at completion was subjected to the pressure of tight gauze packing. That this pressure, maintained at least through the first weeks following the operation, should sometimes influence the wound, is not surprising.

Occasional Results of Pressure by Gauze Packing.—Tissue repair, proceeding normally in certain areas, is retarded or inhibited at others, at which points the bone being deprived of its protective and nutrient granulations, suffers a loss of vitality and consequent superficial necrosis. There can be little doubt that a certain percentage of cases coming to secondary operation owe their failure to this cause.

Repair throughout the entire wound surface being retarded, epidermization from the skin margins has extended into the wound cavity, resulting in eventual recovery, but with the formation of an unsightly cavity, or depression, behind the ear.

Repair throughout the bony wound being retarded, the mucosa lining the tympanic vault has spread outward through the aditus to contiguous wound surfaces. As a result of this, closure of this part of the wound has been indefinitely delayed. The nature of this obstacle to closure of a mastoid wound has not been understood, and many patients have suffered prolonged and painful postoperative treatment and some have been subjected to secondary operation, who but for irrational pressure in the region of the aditus and antrum, would have recovered promptly.

A rational deduction from experience which would seem applicable to all fields of surgery might be stated in the form of a law, namely, that *wounds in the process of normal and healthy repair should be subjected to the least possible mechanical disturbance*. Judged by this standard, we bring still another indictment against this method of treatment. Aural surgeons have failed to appreciate that small new processes of

tissue repair, delicate new granulation, rudimentary efforts at vascular anastomosis were destroyed or set back at each change of dressing.

The foregoing, in my opinion, represents the defects in theory and practice of the operative methods of ten years ago. Nor is it safe to speak of them as belonging wholly to the past, for, as in every field of endeavor, there are many men of established reputation who, with their immediate followers, are slow to abandon methods learned when they were younger.

The Blood Clot Operation.—In passing I want to say a word about the so-called blood clot operation. Its theory was based on the hypothesis that blood possesses inherent bactericidal properties; and that if the wound is closed at the time of operation, the blood collecting therein not only protects from further infection, but actually provides a reticulum, or scaffolding, through which new granulations and blood vessels are projected, the whole being converted into firm and permanent connective tissue.

A weak point in this theory is the fact that in cases of severe tympanic infection, pus from the vault may escape backward through the aditus; and that even if the blood clot occupying the mastoid cavity is not infected thereby, tympanic drainage is cut off, and tympanic suppuration may be perpetuated. That this danger is real is shown by the number of cases in which ultimate breaking down of the wound occurs. This in some cases takes place shortly after the operation; in others only after a much longer period. These considerations have brought the blood-clot theory as applied to mastoid surgery into disrepute.

While the blood-clot theory as such has never appealed to me, there can be no question as to the important influence which the operation, as originally described under that name, has exerted on the surgical methods and growth of the past decade. It at least proved definitely and beyond dispute the possibility of quicker and on the whole better average

results than those obtained by the older methods. Apparently a direct result of the Blake-Reik operation was to stimulate general interest among American surgeons in any rational modification of established surgical methods aiming at quicker average results. Unfortunately the time at my disposal will not permit of even a brief review of the various modified operations which have contributed to our technical knowledge. All that I shall attempt is a brief outline of a simple end operation now in use by many practical surgeons.

Care of the Periosteum.—The initial incision behind the ear should in its central part be placed at least three eighths of an inch behind the auricular attachment. In elevating the flaps an effort to save the periosteum from injury is distinctly worth while. In children and women this is usually not difficult over the upper two thirds of the mastoid. On the other hand, in strong, muscular men, the frequently rough cortex and extensive muscular attachment may make some injury to periosteum even over the upper half of the mastoid inevitable. In any case, attention to this point is of importance, since an intact and unlacerated periosteum is distinctly favorable to postoperative healing.

Treatment of Soft Parts; Drainage.—In healthy wounds, that is, those lined with apparently sound bone and in which no dura has been exposed or even those in which a moderate exposure of healthy dura has been made, the following technic may be followed: A wick of gauze so infolded that no ravel threads may be left when it is withdrawn, is placed in the depth of the wound with one end at the aditus, the other emerging at the lower end of the wound. Over this the flaps are approximated and the wound united from its upper extremity to within half an inch of its lower, or tip, end by interrupted silkworm-gut sutures. The sutures are carried preferably through the entire thickness of each flap so as to approximate not only the skin, but

also the periosteal, edges. This is not assured by metal clips. A gauze wick fills the auditory canal, and the wound is covered by the usual gauze dressing.

Postoperative Treatment.—The dressings are changed daily. On the day following the operation the wick is withdrawn and very gentle pressure with a pad of sterile cotton is applied over the suture line to express serum or pus through the lower (open) end of the wound. The wick removed is then replaced by a much smaller one, which is introduced only from three fourths of an inch to an inch into the wound. Thereafter the wicks are changed at each daily dressing until there is evidence that they are no longer required.

Dependence on the above treatment is based on the hypothesis that the first wick used establishes a drain or pathway of least resistance along which pus escapes as long as drainage is necessary. The small wicks used in subsequent dressings merely maintain the opening at the lower end of the suture line.

There are two fairly reliable signs that this treatment is progressing favorably, namely, (1) progressive and fairly rapid return of drum membrane and tympanic structures to their normal appearance, and (2) progressive diminution of discharge.

I would abandon this treatment and open the wound in any case in which the tympanic structures did not show progressive improvement. On the other hand, I might persist during a considerable period in spite of a fairly profuse, if diminishing, discharge.

Interpretation of Pus.—It is almost a habit of mind to think of pus as a danger symptom, since it always indicates a focus of infection, present or preexisting. In reality, pus per se represents danger only if confined or if its secretion or production is more rapid than its elimination. A raw or granulating wound without secretion is, of course, a surgical impossibility. Given, therefore, a partially closed wound from which we have reason to believe that we have eliminated the

primary focus of infection, we need not be too ready to take alarm at a discharge which may represent only a stage of the process of repair.

I have known wounds treated by this method to have every appearance of being practically healed within ten days. More wounds are healed within three to five weeks. Some for one or other reason do not progress satisfactorily, but after removal of sutures and separation of the flaps, there follows a more rapid process of healing than by the older method.

Theoretically this plan of treatment seems to meet the following requirements: It provides reasonable and adequate drainage; it utilizes every normal structure, bone and soft parts, in the process of repair; it secures the maximum vascular supply of the parts; it subjects the wound in process of repair to the least possible mechanical disturbance.

Contraindications.—That there are contraindications to this method goes without saying. As such I would consider surgical injuries to the sigmoid sinus, physical signs of disease in an exposed sinus wall, and unusual extension of bone necrosis.

Pronounced constitutional symptoms of septic absorption would also call for an open wound, since in such cases the systemic disorder, and not the local lesion, would be the first consideration.

Another condition which, though not a contraindication, should be mentioned in this connection is the presence of large tonsils and adenoids, that is, of the obstructive type. Two cases from my own experience will illustrate what I mean.

In February last I saw, with Dr. Howard Gillespie Myers of New York, a child of 3 suffering from bilateral suppurative otitis media. Both membranes were bulging, though presenting small perforations. The mother had been repeatedly advised to have the tonsils and adenoids removed. Double myringotomy did not bring relief, even in reducing temperature. Ten days after the myringotomy a double mastoidectomy was performed. Following this the temperature returned to normal, but the ears continued to discharge.

Two months after the operation, the aural discharge still persisting, the tonsils and adenoids were removed. Within one week after this operation the aural discharge ceased and both mastoid wounds were healed, leaving, however, a perforation in the left drum membrane which may be permanent.

In April last I was called to see R. M., a boy of 4 years, whose condition may be summarized as follows: Large tonsils and adenoids of obstructive type; acutely inflamed right drum membrane with discharge through small perforation; marked tenderness over right mastoid process.

In this case I decided as a first step to remove the tonsils and adenoids, the drum membrane, of course, being incised at the same time. Five days later, edema over the mastoid developed, and a mastoid operation after the method here outlined was performed. In this case the drum membrane healed promptly and the mastoid wound was completely healed with only a fine linear scar; just three weeks after the mastoid operation.

Probably the correct deduction from such cases would be, not that the presence of tonsils and adenoids are a contraindication to any operative method, but rather that tonsils and adenoids of the obstructive type should be removed either as a preliminary step or at the same time as the mastoid operation. The latter may seem harsh treatment, but children stand it, and the results justify the additional strain.

If the question were asked in what essential feature the operative method here outlined differs from that originally described as the blood clot operation, I should say that a blood clot, allowed entirely to fill the mastoid cavity, may act as an obstacle to pus seeking escape; whereas I should regard as unsurgical any operation which does not take account of and provide adequate drainage.

In conclusion, I need not say that I make no pretense to having described a new or original technic. The method I have described is that followed by many surgeons today. What I have attempted is to show the value of the soft parts and particularly the periosteum in mastoid surgery, and to point out wherein the latter methods are in better accord with sound surgical law.

As to comparative results, my own experience may be stated as follows: quicker average healing and lessened suffering to the patient; better cosmetic results, that is, practical elimination of unsightly depressions; smaller percentage of failures.

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ABSTRACT OF DISCUSSION

DR. R. B. CANFIELD, Ann Arbor, Mich.: All the records and experiments will show the tremendous difficulties we have to overcome in attempting to remove diseased bone in and about the mastoid process. Still, it seems to me that the advance that has been made in the distinctly surgical technic of the operation on the mastoid during the past ten years has been along the line of more and more removing as much of the diseased bone and tissue as we can. As far as the after treatment is concerned, the end result of the successful case is more or less always the same, no matter whether we use one treatment or another, and the after-treatment which interferes the least with nature is the best. Therefore, in deciding on what technic should be used and what advance has been made we should operate as radically as we can without producing too much deformity, and during the after-treatment leave the case alone, to the benefit of the patient. We must remember that all healing takes place in the soft parts, not in the bone, and the condition of the bone of these mastoids which we have to reopen or which we see three to six weeks after operation is a sad commentary on our after-treatment. If the mastoid process has been excavated, the bone looks best immediately after the operation; it gets into a less and less satisfactory condition the more we treat it. I had an opportunity to compile statistics on the first series of blood clot cases, and although I tried to compile these statistics honestly it seemed to me the paper read much more satisfactorily and gave the idea that blood clot operations are much more satisfactory than an examination of the cases would lead us to believe. I have seen fatal complications arise—cases in which the blood clot was removed better without operation, and it is decidedly a nonsurgical procedure. The best surgical technic is that which removes the greatest percentage of disease, and that after-treatment is best which interferes the least with nature's healing of the wound.

DR. CULLEN F. WELTY, San Francisco: I do not think that Dr. Kerrison has placed sufficient emphasis on the removal of the individual cells. The removal of every individual cell that can be found by the Jansen searcher,

has contributed more to the rapid healing than anything else in the whole field of otology. To speak for myself, I rarely operate a case the second time. That was not so ten years ago. In the Politzer clinic 12 years ago, more than 5 per cent. required a secondary operation. The more thoroughly the cells are removed, the more sure you are of a complete cure. By removing every individual cell to hard bone, I am again assured of the fact that the healing is retarded and there will be more or less depression; granulation tissue does not spring up as readily. My cases heal in from three weeks to two months. This is not ideal surgery because of the long duration of healing.

I do not believe in the blood clot operation because an occasional case will develop a serious brain lesion that would have gone along without any trouble by the open method. Some four or five years ago, a New York otologist reported some seven deaths following the acute mastoid operation by the blood clot procedure. On the other hand, I wish to report 120 cases of my own of acute mastoid operation by the open method without mortality; furthermore these cases were not selected. However, I do feel that some one will devise a safe procedure that will shorten the after-treatment of acute mastoid operations, and it seems to me that it will be along the line of what is now designated as the closed operation.

DR. JOSEPH C. BECK, Chicago: Dr. Kerrison's review referring to the last ten years' work on the mastoid is very instructive to those who have had anything to do with mastoid surgery. You heal a number of cases quickly, and then there will be a few that will not get along, although the same technic was employed. It must be something else than the technic employed. I am confident that it is a causative factor such as bacteria that originally produces the disease, and the secondary changes of the bones that have to do with the way these conditions heal up. There are various types of bone disease and each individual type heals differently. Whether this or that method is used the result is usually the same. It does, however, matter whether we have tuberculosis, syphilis, or chronic osteitis of purulent character with or without cholesteatoma. In discussing this subject of healing we ought to separate acute from chronic cases. In the last ten years I have employed a definite technic in a simple mastoid. With an uncomplicated case, where no vital structures are exposed, such as the dura, the sinuses or the labyrinth, the wound is cleaned out completely—I am not particularly enthusiastic about polishing the bone by means of a burr, but after the cavity is clean, the wound is packed loosely with a strip of gauze, a rubber tube is inserted in the opening of the antrum and the drainage gauze and tube allowed to come out through a stab wound. The main incision is primarily closed. Just

as soon as the discharge from the external auditory canal stops the drain material is removed and the cavity of the mastoid allowed to close just as any other. I am now speaking of uncomplicated cases, and I mean by that that the discharge and the hearing correspondingly improved. Just as long as there is discharge from the auditory canal I allow drainage from the wound. In the radical mastoid the cavity is never packed primarily, and only when that little space between the facial spur and the upper portion of the tegmen begins to narrow, then we sometimes pack lightly. We do not now make use of any skin grafting.

DR. WENDELL C. PHILLIPS, New York: I am very often asked the question by students and other observers what I consider should be the extent of the mastoid operation, and my invariable reply is that there is no limit to the operation, except the limitations of the disease, and that ought to be the rule that is followed by every operator. Unfortunately, the disease so frequently does extend even beyond the confines of the temporal bone that men of limited experience do not completely excavate the diseased bone and thus bring about conditions that require a second mastoid operation. I have no doubt that Dr. Kerrison meant to imply that the extent of the operation is the limitation of the diseased area. I remove the entire area of diseased bone and all granulations excepting at one point, and that is in the tympanic portion of the mastoid antrum. I do think it is dangerous to do much curetting around here on account of the danger of disturbing the incus. Experience has proved that nature will attend to the granulations in this area. I wish also to say that one of the points where men fail in the simple mastoid operation to get the diseased bone removed is in the region of the zygoma. In most of my operations I find it necessary to cut away the cortex over the zygoma as far forward as the middle line of the external auditory canal in order to get to the point of limitation of the disease. Regarding the healing process, I quite agree with Dr. Canfield that it is not so much the method we follow in the after-treatment as the method we follow in the operation itself. You can close the wound largely and drain it with a strip of gauze, and then you will have a sinus that will remain for six or eight weeks before it will heal; or you can leave it wide open and pack it.

I must take issue with Dr. Welty if I understood him correctly when he inferred that all post-operative temperatures are due to the fact that all the diseased bone has not been removed. We know that we have postoperative temperature where the bone has been completely removed, and there are various reasons for it. I wish to emphasize one more point in connection with the healing process. We all have delayed cases, where the granulations do not come

toward the center, where secretion persists, where there are flabby granulations, especially when an extensive operation has been done. Under these circumstances we must look elsewhere for the cause and we all know that there are underlying dyscrasias which may account for it. Here it is wise to call in the family physician and get him to examine the urine, the intestinal organs, and find out if there is not something wrong with the general physical condition of the patient, and it is marvelous what results we get and how rapidly they improve when these conditions are corrected. Sometimes as simple a remedy as bicarbonate of soda will have a marvelous effect on the healing process.

DR. PHILIP D. KERRISON, New York: Dr. Beck's reference to bacteria is important—a point I did not take up. My paper was intended simply to give certain rational grounds for making a better attempt to utilize the soft parts than has been done in the past. My own experience is that this can be done with perfect safety, and with a quicker and a better cosmetic result. The soft parts play a more prominent part in the process of repair than aural surgeons generally have considered to be the fact.

VACCINE THERAPY

ITS POSSIBILITIES AND LIMITATIONS *

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A discussion of the possibilities and limitations of any topic involves more or less prediction. In science it is dangerous to predict and especially is this so just now concerning the subject at hand, because we are in the midst of a revolution in methods and in interpretations as applied to this field. It is with reluctance, therefore, that I attempt to present this subject, because I feel it can not be adequately done at this time.

After an attack of many infectious and contagious diseases, such as typhoid fever, smallpox, measles, scarlet fever, the body becomes for a long time highly resistant to the given disease, but not to any other disease. The conception of specificity is here clear and definite.

Many years ago Jenner found that smallpox in the modified and relatively harmless form of cowpox could be given to human beings and that they were then almost as resistant to smallpox as if they had had the disease.

Pasteur, years later, showed that by injecting into animals certain modified living viruses (chicken cholera and anthrax) the animals then became resistant to natural infection and also to experimental infection with that germ. This was true, however, of certain viruses only. The injection of the virus of many other diseases did not so protect against subsequent infection.

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Later, Pasteur in his great work on rabies took advantage of the long incubation period in this disease and by the early injection of the modified virus contained in the spinal cord of infected rabbits was able to protect animals and man against the fatal outcome sure to follow in case symptoms once appeared. This method, it is important to note, is in reality protective and not curative, because it is not effective if begun late or after the first symptoms have set in.

Based on such experimental and clinical facts, which accumulated rapidly following the work of Pasteur, animals and man were given dead or modified living germs for protection in a variety of diseases. Up to the present time this method has been used with marked success in man in typhoid fever and with some, but less definite, success in plague and in cholera. In animals, in symptomatic anthrax, swine erysipelas and rinderpest, marked success has been attained.

For certain few diseases, then, the prophylactic use of specific vaccines has been thus far successful in both animals and man, but in the great majority of infections it has not been successful to any appreciable degree. I wish to emphasize this point because it is in prophylaxis that we have the most favorable conditions possible, according to our fundamental principles of immunity, for the action of vaccines. However, the marked success that has attended their use in such diseases as above enumerated establishes a practical and rational basis for their possible value in all infections. Whether or not they will be efficacious in a given disease will of course have to be determined in each instance.

I have referred to the above facts concerning prophylaxis because of their bearing on the curative use of vaccines. *A priori*, on the basis of immunity principles, we could hardly expect to obtain better or even as good results when the virus is introduced during the course of the disease as when introduced previously. What are the facts?

It was early observed that vaccination with cowpox virus during or after the onset of smallpox had no effect on the course of the disease. Pasteur was well aware of the possibilities of a curative therapy as well as of a prophylactic one, but he reports no results of importance along curative lines. Even to this day it is interesting to note that in the domain of animal diseases, which have been so fertile in furnishing valuable data for prophylactic therapy, there are no natural diseases known in which vaccines for curative purposes have been of any appreciable value. Indeed there is empirical evidence that vaccination just before or during an attack of a disease may do harm. Veterinarians are careful not to expose cattle to infection soon after they have received prophylactic anthrax vaccine.

Koch's work on tuberculosis in 1890 was perhaps the first serious attempt to apply vaccine therapy to the human and it was, as we all know, a failure at that time. Scores of attempts with almost every imaginable modification of the bacillus, including extracts and bodies, have since been made. Biggs states that treatment with tuberculin on the whole is being gradually given up in this country. This is after a trial of twenty-five years. It should not be understood from this statement that such treatment has no virtue whatever. Trudeau's results would seem to indicate that when used discriminately tuberculin has some value perhaps in immunizing against the toxin. A curative vaccine against the bacillus has, however, not been found.

Fraenkel in 1893 used subcutaneously dead typhoid bacilli in the treatment of typhoid fever, with what he considered good results. Rumpf shortly after claimed as good results when pyocyaneus bacilli were used in typhoid, thus very early questioning the specificity of vaccine treatment. In recent years many reports have appeared dealing with this subject, the results being somewhat conflicting. Beginning with the use of intravenous injections by Ichikawa in 1912 and by

Gay and Chickering soon after, the treatment of typhoid, on account of termination by crisis in a considerable proportion of cases (30 to 40 per cent.) thus treated, has excited much interest.

Wright in 1902 inaugurated a new era in the use of vaccines by his discovery of opsonins. This subject is so well known I will not enter into detail. As contrasted with Koch's and Fraenkel's work, it attempted to place the use of bacteria and their products in the treatment of disease on a rational basis, controlled by a carefully determined standard, the opsonic index. According to Wright, vaccines were suitable in certain subacute and chronic infections, the object being to stimulate the protective agencies of the body in order to rid it of localized and perhaps more or less protected foci. Acute infections were not considered suitable for the use of vaccines, though it should be stated that from time to time reports appeared indicating that good results were occasionally obtained in acute cases. Such results were not altogether in harmony with Wright's theoretical conceptions because in severe acute infections the defenses of the body were considered already overwhelmed and vaccines merely added to this toxemia.

Wright's work has been based on the principle of specificity, as was nearly all the work on this subject before his time. It is interesting here to note how thoroughly this principle has dominated the thought of men since the beginning of the bacteriologic era. The idea of specificity rests on an absolutely secure basis of clinical and experimental facts. Yet it is perhaps not an overstatement to say that for many workers it has become a dogma. Wherever the principle seemed to apply it was not thought necessary even to use controls in the observations. So in the therapeutic application of vaccines, if good results were obtained, it was taken for granted that this was dependent on the specific effect of the vaccine and no thought was given to the possibility of other vaccines or substances

producing the same effect. This was due, I think, largely to the very indefinite results obtained by the subcutaneous use of vaccines in many diseases. For since the intravenous use of vaccines and other products, decidedly more definite results are possible and control observations with numerous substances can more readily be made.

Following the work of Wright, careful and scientific as it was, there occurred a flood of commercialism in connection with the preparation of vaccines and bacterial products of all kinds. Apparently it matters little in this age what the therapeutic agent may be, if it is possible to commercialize it, this will be done. The abuse of these products has been discussed so well and so recently by Pearce, Theobald Smith, Hektoen, Billings and others that I will not dwell longer on this point.

Scattered throughout the literature are the reports of more or less isolated observations that in the treatment of infections, both acute and chronic, good results have followed the use of nonspecific substances. Though many of these reports are quite definite, indeed some decidedly more so than those obtained by specific therapy, since they did not appear to be in keeping with the dominating conception of specificity, they were regarded with skepticism or indifference. This subject has very recently been thoroughly developed and the specific facts stated by Jobling and Petersen.¹ The problem largely centers around the toxic effect of colloidal substances, especially the foreign proteins, on injection into the body.

The favorable results first reported by Kraus, Ichikawa and others by the intravenous injection of typhoid vaccine in typhoid fever were soon followed by the further reports of Kraus, of Luedke² and of J. L. Miller³ that equally good results could be obtained with

1. Jobling, James W., and Petersen, William: The Nonspecific Factors in the Treatment of Disease, *THE JOURNAL A. M. A.*, June 3, 1916, p. 1753.

2. Luedke: *München. med. Wehnschr.*, 1915, lxii, 321.

3. Miller, J. L.: *Illinois Med. Jour.*, 1916, xxix, 8.

other substances, such as colon vaccine or even with solutions of proteins, albumose, etc., in this infection. Mueller and Weiss⁴ have obtained striking results in arthritis, especially gonorrheal arthritis, by the intra-gluteal injection of sterile milk and of sodium nucleinate, both of which substances cause a marked reaction. Smith⁵ calls attention to the value of an anaphylactic reaction, in gonococcus infections obtained with horse serum, normal or antigonococcic, it matters not, provided the allergic phenomenon is manifested. Miller and Lusk⁶ report striking results in acute, subacute and chronic arthritic conditions of various types by intravenous injections of typhoid vaccines and proteose.

In our laboratory Culver, engaged recently in this work, reports that in the treatment of gonorrhea and its complications, especially arthritis and epididymitis, with the intravenous injection of bacterial suspensions, there seems to be no specific reaction when gonococci are used as compared with other organisms. The results have been very pronounced in most cases, marked relief following a single injection. The suddenness of the reaction and the severity as characterized by chill, high temperature and leukocytosis are more marked following the injection of meningococci than following either gonococci or staphylococci. The improvement seems to be in proportion to the temperature and leukocytic reactions. As to recurrence of the infections, nothing can be said at present as sufficient time has not yet elapsed.

Mathers,⁷ working especially on lobar pneumonia and erysipelas, reports that these infections have been treated during the acute stage by intravenous injections of various vaccines and protein solutions. Suspensions of typhoid bacilli, pneumococci, staphylococci and streptococci have been used, as well as normal horse

4. Mueller and Weiss: *Wien. klin. Wchnschr.*, 1916, xxix, 249.

5. Smith, L. D.: *The Value of Anaphylaxis in the Treatment of Gonorrheal Complications*, *THE JOURNAL A. M. A.*, June 3, 1916, p. 1758.

6. Miller, J. L., and Lusk, F. B.: *The Treatment of Arthritis by the Intravenous Injection of Foreign Protein*, *THE JOURNAL A. M. A.*, June 3, 1916, p. 1756.

7. Unpublished data.

serum, diphtheria antitoxin and various protein solutions, both animal and vegetable. All of these substances, when used in sufficient dosage, may give rise to a characteristic febrile and leukocytic reaction which in some instances was followed by a temporary clinical improvement. No evidence has been gained, however, which would indicate that the specific vaccine in these diseases excels in any way the nonspecific antigen. Mathers infers from his experience with erysipelas and pneumonia that the therapeutic results from this method of treatment do not warrant the general application of this method. He has also observed that citrated human blood produces a reaction similar to that described above when injected intravenously in amounts usually advised in transfusions.

Since these very striking results have been obtained by the use of nonspecific proteid substances, the specificity of treatment with serums in pneumonia and other infections and with vaccines, especially in typhoid, as reported by Gay, and in the many other diseases in which apparently good results have been obtained, may be called into question.

My own experience with vaccines, which began in 1904, has included a variety of infections, both acute and chronic. I have observed in certain cases, especially arthritic cases, and also in some colon infections, definite reactions, with chill, fever, leukocytes, etc., followed by a striking improvement. This experience, I think, has been a common one, especially by those who have used large doses as well as small doses of vaccine. Naturally, the interpretation usually given to such reactions has been that they were specific responses on the part of the body to its autogenous virus. In the light of the newer facts we are inclined now to view such reactions as probably nonspecific and of the same nature as those following the injection of any foreign protein.

One difficulty in vaccine therapy has been to explain the good effects sometimes seen in the treatment of

acute infections with vaccines. Wright himself and many other conscientious workers report such instances. As stated above, on the basis of the opsonic theory of Wright, this mode of treatment of acute infections was not a rational one and indeed was contraindicated. We may now believe that such favorable results were no doubt due to the nonspecific reaction caused by the bacterial protein.

At the present moment the facts would seem to indicate that the nonspecific substances referred to are able to do almost everything the specific vaccines have done in the cure of disease. In other words, the curative effects of vaccines reported heretofore may be explained by the action of the nonspecific substances in the vaccine rather than by its specific factors.

Jobling and Peterson,¹ in their analysis of the mechanism of the action of nonspecific therapy, call attention to a number of factors involved in this process. Selective stimulation of the hematopoietic tissues occurs, which results in flooding the body with antibodies which are specific, but the stimulus may be nonspecific. Hyperpyrexia and leukocytosis, emphasized especially by Gay and his associates in the recovery of typhoid by this form of therapy, and the mobilization of serum protease and lipase, with an ultimate rise in the antiferment titer of the serum following injection of various foreign substances, are considered significant processes. These processes, they suggest, are dependent on certain changes resulting in the state of increased dispersion of colloids affecting both the serum proteins and the serum lipoids. Such changes are able to be brought about by a variety of substances which result in reactions clinically and therapeutically almost identical.

In such infections as the local staphylococcus infection of the skin and in some others in which, since Wright's first work, so many favorable reports have appeared it is quite possible that so far as immediate results are concerned a nonspecific foreign proteid

might act as well. However, in such cases there seems to be another factor concerned, namely, the specific immunity factor operating to prevent a recurrence of the infection. The nonspecific protein would probably not influence this factor and the use of autogenous organisms would be desirable for its immunizing effect. Therefore, where both a curative and preventive effect is desired, it would seem that the autogenous vaccine would be advantageous over a nonspecific proteid substance, which might have only a curative action.

Subcutaneous injection of foreign proteins may behave quite like the intravenous injections, though the action is slower and the dose required for the desired effect is probably somewhat larger. On account of the very severe reactions occurring at times after the intravenous method, the question may be properly raised as to its possible dangers. Evidently further data are needed here, but if a proper reaction can be elicited by subcutaneous use, this route might be preferred on account of simplicity and perhaps safety. Even subcutaneous use of large doses may not be entirely free from harm. The writer knows of a case which, following a large subcutaneous dose of dead meningococci, developed a typical reaction manifested by a severe chill in thirty minutes, followed by fever of 103, nausea, vomiting, with leukocytes on the third day numbering 45,000. On the second day the urine contained albumin and large numbers of granular and hyaline casts, which persisted for several days.

An enormous number of patients are now being treated and will be treated throughout the country by this method. Much of it will be done by inexperienced men and no doubt we may expect some serious accidents to occur. I think it behooves us to take a conservative stand in the administration of these preparations and to advise strongly against the use of all sorts of unstandardized bacterial products which are now offered and will be offered to the profession.

In case it is shown conclusively that, for therapeutic purposes, any foreign protein may serve, the logical preparation for use would seem to be a sterile pure chemical preparation of some proteose, which can be carefully standardized. Such a substance would be far more reliable and satisfactory than the various vaccine mixtures and extracts now flooding the country.

SUMMARY

Recent work tends to show that many substances, the so-called foreign proteins and their derivatives, may, when injected especially into the veins, quickly cause a severe chill followed by high fever, leukocytosis and certain changes in the blood, especially the appearance of ferments. These proteins may be derived from disease germs or they may consist of other animal substances, like serum, proteoses and milk. After the rather severe reaction marked improvement and even permanent cure may result in certain diseases, especially in typhoid fever, and in rheumatic and gonococcus infections. This may be due to the high fever and to the increase in the ferments and the leukocytes of the blood. Other factors are probably at work.

The nonspecific effect of vaccines is just now probably the most important problem that concerns the vaccinationist. The possibilities of development along this line are many, for the principle concerns an immense number of diseases, both in man and the lower animals. Questions concerning ultimate cure, recurrences, relapses and dangers can not now be justly appreciated because of lack of data.

This form of treatment should be referred to neither as specific nor as vaccine therapy. It is nonspecific, and usually, but not necessarily, protein therapy.

The important domain of vaccines is protective, not curative, according to present data.

CLINICAL EXPERIENCE WITH THE USE OF VACCINES IN DISEASES OF THE EAR, NOSE AND THROAT

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In the consideration of such a subject as is indicated by the title, it is evident that full justice cannot be done to each disease of the upper air passages with which immunotherapy has been tried. The option will therefore be exercised by the writer of selecting those which have been most extensively studied or are most prominently before our branch of the profession today, and endeavoring from the works of others, as well as from his own experience, to arrive at a just appreciation of their present value. He may as well confess at the start that he is a believer in this form of treatment, although admitting that it is often far from satisfactory in the light of our present knowledge. He feels somewhat diffident in presenting this subject to you and commenting favorably on the results obtained, in view of the present tendency to belittle vaccine therapy, either prophylactic or curative, specific or nonspecific.

In reality, only the threshold has been passed in the study of immunology as applied to ear, nose and throat diseases, many problems remaining to be investigated, among which might be mentioned improved methods of taking cultures and of determining the infecting organism or organisms, the preparation of more efficient vaccines, whether by sensitization or otherwise, some accurate method of counting organisms and of determining the dosage for different organisms and different individuals. And it is well to sound a note of

warning at the outset, that vaccine therapy, much as may be hoped for it in the future, will probably never supersede the surgery that is necessary for drainage and for the correction of abnormalities that by their presence keep up irritation of the tissues and thus are conducive to reinfection by the same or another type of organism. Much as we should like to immunize permanently against everything, in spite of such malformations, it seems hardly probable that this Utopia will ever be reached.

In the popular craze for giving vaccine treatments which has pervaded alike the specialist and the general practitioner, vaccines have been administered for every known and unknown disease, with reason or without, more often the latter. This has been, to a large extent, due to the many commercial brands on the market and the often absurd claims put forth for them by their makers. By this it should not be inferred that these popularly called stock vaccines are without use or value, for many men have obtained results by their employment. From the very nature of the case their use is imperative in certain conditions, even the much abused mixed varieties, often miscalled polyvalent; and these vaccines must not be confused with the stock suspensions of the home laboratory, also at times a most useful product. Warning must also be issued against the confusion existing in many minds, or at least on many tongues, and this not by any means confined to the laity, between serology and vaccine therapy. It is needless to define the terms to this audience, but bacterins are so often miscalled serums that it has seemed necessary to call attention to these two distinct immunity-producing methods of treatment, since only the first will be considered here.

THE NOSE

Acute Rhinitis.—Probably the most general adaptation of vaccines to ear, nose and throat practice has been their use for the prophylaxis of acute rhinitis or

common cold, not only by the specialist, but by the general practitioner, the country over. So much so, indeed, that patients now demand the so-called serum treatment. The mere fact that it has come into such general use by physicians and general demand by the laity would indicate at least some value in this method. Most of the immunization is, of course, necessarily done with the aid of commercial mixed vaccine of the many well-known different brands on the market. It would be manifestly impossible to culture the causative organisms for the next cold from every nose at present in healthy condition, although it is probable that in a certain proportion of cases organisms would be obtained from which competent vaccines could be made. In case the patient is subject to repeated acute colds, cultures taken during one of these may be used for vaccine preparation and prophylaxis against future ones, with most excellent results.

Taking it for granted then that the use of vaccines for the prophylaxis of acute rhinitis is of value, one would naturally ask of how much value this method is. Many cases, of course, will fail to respond, due probably to the fact that the organism causing the cold is not in the vaccine used whether it be autogenous or commercial mixed. For it is quite possible that in taking the culture from the nose the causative organism may not be obtained. In this relation the work of G. B. Foster,¹ recently published, in which he seems to demonstrate as an etiologic factor in acute rhinitis minute filterpassers or filterable toxins, would very readily explain these failures. By accepting this work as being of great value, we must not forget that the old, well-known organisms do cause a certain percentage of rhinitides, or at least by secondary infection prolong them to their customary length, and when due to them, vaccine treatment will prevent or cure a very considerable proportion.

1. Foster, G. B.: The Etiology of Common Colds, *THE JOURNAL A. M. A.*, April 15, 1916, p. 1180.

The duration of immunity depends much, of course, on the amount of exposure, the individual peculiarities of the patient, the amount of vaccine given, and the presence of epidemics. For instance, a patient subject to attacks of acute rhinitis every few weeks may be so immunized that the interval will be stretched to six, eight or ten weeks or longer. The individual who has one or two bad colds during the winter may be immunized so that he will go from year's end to year's end without any. These immunized patients frequently start apparently to have colds, that is, sneezing, sniffing, coryza, etc., which symptoms pass off in the course of a few minutes or a few hours. This is readily explained if we consider the probable etiology of many colds, change in temperature of the air inspired or impinging on certain dermal surfaces excites reaction in the vasoconstrictor and vasodilator and secretory centers and a corresponding relaxation of the nasal mucosa, an increase of blood, secretion, sneezing, etc. Here it probably is that the infection takes place and prolongs the cold. If the patient is immune to infection the cold disappears with these few symptoms.

In this connection, a word or two on the treatment of acute colds is appropriate. If colds are treated early, there is no doubt that a great many of them may be stopped short, that is, within twenty-four hours. But, of course, to do this an autogenous vaccine cannot be used, nor can a bacterial diagnosis, as a rule, be made on account of the shortness of the time. Acute tonsillitis is in precisely the same category. The well-known rôle that acute rhinitis in repeated attacks plays in diseases of the ear will at once convince the aural practitioner of the value of this prophylaxis. While the actual condition may or may not be improved by the vaccine, there can be no question that the lengthened interval between attacks and the diminished severity of them makes it possible to obtain results in the treatment of recurrent acute

catarrhal otitis media and chronic catarrhal otitis media that are not possible without some such method of treatment for the nasal condition.

Accessory Sinuses.—What has been said here in relation to diseases of the ear applies equally to acute and recurrent diseases of the accessory sinuses of the nose. Vaccines, as a rule, have but little influence on suppurations of the various sinuses, except under certain conditions. When free drainage is obtained, the use of appropriate potent vaccines will usually hasten a cure. Of if given before operation, the individual's immunity will be so raised that it will accomplish the same result. But, as in diseases of the ear, perhaps their greatest value is in preventing the recurrent acute infections that so often terminate in an attack of sinusitis. The reports would indicate that the use of vaccines in cases in which the given sinuses are filled with pus with insufficient drainage is entirely useless.

Much of what has just been said is, of course, well known and to a certain extent may be considered established, although the numerous failures that everybody has have produced many pessimists in regard to vaccine therapy.

There are two new subjects to be included under the title of this paper that are of interest, besides the pollen treatment of hay-fever, which is not, of course, a vaccine treatment, although it approximates it and will, therefore, not be considered.

Ozena.—The treatment of ozena by any method has, as every one knows, been most unsatisfactory, and commissions have, at times, been appointed by various national scientific societies to study the question, but without obtaining any results. Within the last few years Hofer of Vienna, working in collaboration with Koffler, unearthed the forgotten contention of Perez that a bacillus, supposed to be of the Friedländer group and called by him the *Bacillus ozaenae-foetidae* was the cause of ozena, and could be found on and

isolated from the mucosa underlying the crust. Two of the early workers in this field were Skillern and Holmes² of this section and their report was one of the earliest. Their findings were, as far as they went, similar to the above. Hofer and Kofler followed the lines laid down by Perez, and later by Skillern, treated their patients with vaccines, not autogenous, but made by themselves from half a dozen different strains, and therefore polyvalent. Their results, while by no means uniformly good, were on the whole very encouraging, and a number of Americans in the last two years have studied with Hofer and have obtained various results by his own or modified methods. Some reports have given us total failure, others, notably Horn of San Francisco and Klenk and Guggenheim of St. Louis, claim almost universal success.

Horn, however, disproves the contention of Hofer that the *Bacillus ozaenae-foetidae*, or the coccobacillus, as he calls it, is at all related to the Friedländer group, but claims that it is a motile and flagellated organism similar to, if not identical with, that which causes distemper in dogs, the *Bacillus bronchosepticus*. He uses agglutination tests to aid in his diagnosis and administers to his patients a polyvalent stock vaccine of his own preparation and claims almost 100 per cent. of improvements or cures. Klenk and Guggenheim prepare autogenous vaccine for their patients with good results. If Horn's contention proves to be correct, that the coccobacillus is not of the Friedländer type, but belongs to the colon and typhoid group, it would seem that most investigators have been on the wrong track and have been working with the Friedländer itself, which is probably a normal inhabitant of the nose. In this connection, however, Friel³ claims excellent results from the intravenous injection of a sensitized living vaccine of Friedländer's bacillus. He

2. Skillern, R. H., and Holmes, E. B.: New York Med. Jour., Aug. 15, 1908.

3. Friel: Lancet, London, January, 1916.

gives this in very small doses, 2 million only, and avoids severe constitutional symptoms. If the etiologic factor in ozena is not an organism of the Friedländer group, this treatment would only avail by immunizing against a secondary Friedländer infection, which might improve the patient's condition greatly. Indeed, the writer has seen some apparently good results with a killed, nonsensitized vaccine of this organism given hypodermically.

Dan McKenzie of London, a keen and usually capable observer, has just issued a claim and offered proof, that ozena is a manifestation of tubercular infection, not nasal, and believes the acid-fast bacilli which he invariably finds underlying the crusts to be attenuated forms of tubercle bacilli. His reasoning in reaching this conclusion is out of place here, but he claims very great improvement, if not cure, following tuberculin treatment, the usual small dose, without reaction, being used. While he noted marked improvement in a large percentage of cases, he found a tendency to relapse following the cessation of treatment. There was also a concomitant gain in strength and health.

Asthma.—Babcock, as well as others, has called attention to the value of autogenous vaccines in the treatment of essential asthma, and it seems not out of place to refer to it in this paper. He considers essential asthma to be an anaphylactic reaction to some form of foreign protein, whether it be animal emanations, pollen, food substances, such as fruits, vegetables, meats and shell fish, bacterial proteins from the accessory sinuses, the ears, the tonsils, pyorrheal pockets, gastro-intestinal absorption, gallbladder infection, etc. His method of combating this distressing infection is to search most industriously for the source of the protein absorption and to eradicate it, if possible, using an autogenous vaccine, in addition to the surgery, if the focus is found in the body. Besides that, or if no such focus is found, he makes an autog-

enous vaccine from the bronchial sputum, which can always be obtained in large quantities in these cases.

He finds the usual organisms of bronchitis or tracheitis and in addition an anaerobic organism, which he cannot classify, but which he believes to be the main cause of the asthmatic attacks, and whose inclusion in the mixed vaccine prepared seems to be necessary. By this technic he claims that most patients with essential asthma, uncomplicated by organic disease of the heart or kidneys, can be cured or at least permanently relieved. This is of the utmost importance to us who make a study of the diseases of the upper respiratory tract, and must of necessity be intimately connected with our line of work. It emphasizes perhaps as much as anything else the fact that we must not depend on vaccine alone for the treatment of our patients. The necessary surgery to secure drainage and the eradication of foci of infection is absolutely essential, and given these conditions, and an intelligent use of vaccines, great results may be anticipated. And this applies not only to asthma, but to all diseases of the ear, nose and throat.

THE EAR

There are six more or less distinct conditions of aural infection, all but one related to each other, in which vaccines have been used with some degree of success, and it is proposed to consider them in their order of severity.

Otitis Externa Diffusa et Circumscripta (Furunculosis of the External Ear).—It is well known how trying, though seemingly how trivial, this affection often is to patient and physician alike, and its well-known tendency to a succession of infections or recurrences in one or both ears or alternating between the two. It is analogous to the ordinary acne vulgaris, but it is not identical with it, and it is preeminently a very localized process and distinctly amenable to vaccine treatment. As the furuncle yields ordinarily

to local treatment or is self-limiting, it is not until there is a succession of them that there is a distinct call for more definite immunization and prophylaxis against the recurring crops. Then a vaccine made from the infection evacuated by the knife will often prove most efficient in terminating the trouble. For treating the initial lesion this is manifestly impossible since by the time pus has formed in sufficient quantity for obtaining a culture that particular infection is almost at an end.

If from the history of the case it is feared that there will be more following, the wise immunologist will proceed to have a vaccine made and administer it to guard against this contingency. In case the infection is of that obstinate, painful type that shows no tendency to localize and soften, to "point," in common parlance, a stock vaccine may be utilized, since most, if not all, of these infections are caused by either the *Staphylococcus albus* or *aureus*. Left-over suspensions of these organisms, prepared for the treatment of other patients and properly preserved, frequently answer well for this purpose, or for use pending the preparation of an autogenous vaccine. If these preparations were polyvalent perhaps they would be more uniformly successful even than they are, although frequently they are most efficient. Naturally, if the infection has localized and pus is present there is a positive indication for drainage, whether vaccines are used or not. If they are a very fair prognosis for freedom from recurrence may be given.

Acute Catarrhal and Suppurative Otitis Media.—Like the preceding, acute catarrhal otitis media is a more or less self-limited affection hardly calling for the artificial production of immunity except in the treatment of the nasal condition in which it has its origin. However, if we have it in the recurrent form, cultures taken from the tympanum, or in default of this, from the nasopharynx, will produce a vaccine that will have a distinct limiting and prophylactic effect. Here again

necessary drainage must be obtained either through the eustachian tube or the membrana tympani, and the contributory tonsils and adenoid removed. It must also be remembered in estimating the results in this as well as the more severe variety of the same disease, acute suppuration, that the natural tendency is to get well, almost in spite of treatment and the mere fact that this is accomplished must not be attributed solely to the vaccine until a large number of cases has been carefully studied in detail. This has been done by Weston and Kolmer, as quoted in a previous paper, and it was shown that in a large number of cases the length of time for cessation of discharge in these suppurations was very materially reduced by the preparation and administration of autogenous vaccines.

Chronic Catarrhal Otitis Media.—So far as the writer can learn by a search of the literature, by his own experience or by the process of reasoning, vaccine therapy can have but a small direct influence on our chronic catarrhal ears. In these the damage is done, and except for the treatment of the tubal and nasopharyngeal condition, aggravated by repeated acute nasal infection, which has been discussed above, little can be expected from it. In this latter respect, however, results, albeit not brilliant, may be obtained.

Chronic Suppurative Otitis Media.—Some years ago, when it was first announced that the use of vaccines would in large part supersede the accepted methods of treatment for chronic suppurative otitis media, much doubt was expressed, and many workers took up the question to achieve, in the main, only disappointment. While not as brilliant, on the whole, as many were led to expect from one or two notable series reported, the method undoubtedly has its uses, if also its limitations, and it is the feeling of the writer that it should always be given a fair trial before proceeding to the court of last resort, namely, the radical operation, except where very distinct contraindications

exist that may endanger life by delay or at least make all chance of success hopeless. Such contraindications are any symptoms pointing to the imminence of intracranial involvement, probably labyrinth suppuration, extensive caries of the tympanic walls, chronic mastoiditis and cholesteatoma.

However, even when success is not obtained by the use of vaccines in this condition and it eventually becomes necessary to proceed to the radical operation, the ground has been well prepared, a certain amount of immunity established, and the chances are that healing will be more rapid and satisfactory. The treatment of chronic suppurative otitis media by vaccines is perhaps as complicated and difficult as that of any other disease in the body. Almost always a mixed infection, it is extremely difficult to detect and isolate causative organism or organisms and all depends on the technic employed and the success obtained in this very first particular. The method adopted by most workers in this line is to cleanse the external canal and middle ear thoroughly by swabbing or suction, sterilize with alcohol for various lengths of time, then by inflation or suction, produce a drop of pus or moisture in the middle ear and from this take the culture with a sterile platinum loop. In this way only can contaminating saprophytes be avoided. The sterilization may be too complete, in which case no growth will result and it will be necessary to repeat the process, but no particular harm has been done other than the delay of a few days.

With a potent vaccine made from the proper organism results will depend on the proper dosage, intervals between doses and possibly to a certain extent on the local treatment which should be carried on simultaneously with the vaccine administration, except when cases are being cared for by this method experimentally to determine its value. In these cases, no local treatment should be given. If a case is about to respond favorably to the vaccine, a local reaction

is first obtained on the arm at the site of injection and a focal reaction in the ear consisting usually of a sensation of heat, an increase and a thinning of the discharge, followed after a few days by a diminution and thickening. If no improvement is observed after five or six doses have been given, or if improvement has followed up to a certain point and then ceased, the vaccine treatment is discontinued, the patient allowed to rest for a few weeks, and further cultural studies made of the ear, at which time it may be determined that the type of organism has changed and that a fresh vaccine will be made up of a new group of organisms. No one is justified when a mixed culture is obtained, as it usually is, in picking out one or two organisms and discarding the others. All organisms included when the culture has been taken in the way outlined above, should be made into vaccine. By this it is meant they should be plated out and grown separately and mixed finally. Many early failures in the hands of the writer were due to arbitrarily picking out certain organisms which were thought to be causative and discarding others, notably the *Bacillus pyocyaneus*, which was not supposed to be pathogenic. It was found, on the contrary, that the *B. pyocyaneus*, when included in the mixtures or when used in pure cultures, gave probably the best results of all vaccine treatment.

It is impossible to say in what proportion of chronic suppurative otitis media the discharge can be arrested. It is not well to use the word cure because of the well-known tendency to recurrence after any method of treatment, and while it seems probable that this tendency is much less after proper immunization, still it must be recognized that it exists. In studying results also, just as in the acute diseases mentioned above, it must not be forgotten that many of these ears become dry under ordinary treatment or even without, so that due allowance for this must be made. In arriving at conclusions as to the value of vaccine in this

disease, care should be used in excluding as far as possible this spontaneous result by taking only cases of proved chronicity which have been under all other methods of treatment for a long period of time.

A series of fifty cases of this type, recently reported by the writer and his assistant, M. S. Ersner, showed dry ears obtained in only 46 per cent. But in view of the fact that otherwise all of these cases would have gone to radical operation for a cure, it would seem that something has been gained. The problem here, it would seem, is to find some method of determining which organisms are the true pathogenic ones. This was attempted last year in connection with the series just mentioned and twenty-five complement fixations were done on these cases, with a negative result in all. The reasons for failure were possibly the facts that only three polyvalent collections of organisms were used as antigens or because of the extreme local character of the process in the middle ear and the constant lack of sufficient antibodies in the blood to give the reaction. Much work might be done along this line to very great profit. In this same series of cases there were no positive Wassermann reactions among the failures, but there were five positive von Pirquet tests.

Mastoiditis and Its Complications.—No one will advocate dependence on vaccines for the treatment of a case of acute mastoiditis if this is avoidable, though it is conceivable that they may be used if for some reason operation is out of the question or might bring added danger. There would be no objection to their use during the period before operation of a slowly developing mastoiditis. They would at least do no harm and would probably raise the patient's resisting power sufficiently to make quick recovery possible. They must, however, in no sense be considered to take the place of the mastoid operation in case this is possible and imperative, but several times in the practice of the writer and many times by personal reports to

him from other practitioners, the administration of vaccines has put a definite check to a slowly progressive mastoiditis or has been the determining factor toward resolution in one that was at a standstill.

While definite failures to produce this result have also been reported, it is the opinion of many that it is often a useful procedure. That it is dangerous teaching is evident, as it may hold out hope for recovery until the time of election for operation is past, and vaccine should therefore be used with the greatest care and judgment in mastoiditis and the indications for operation closely watched. At the time of operation, pus recovered from the mastoid should always be sent to the laboratory for bacterial diagnosis, and it is the writer's custom either to have a vaccine made at once or at least to keep subcultures going until it is determined that a vaccine will not be needed. The first method is preferable, as it is very little more troublesome and the vaccine is ready for use if the case does not progress satisfactorily. Indeed, it would seem wise to use the vaccines in all cases as soon as prepared after operation, since healing is more prompt by their use. When we come to intracranial complications and general septicemia, vaccines are of no avail. In this acute general process antitoxins and sera should be the more scientifically correct, but evidently do not seem to have been of very much use in practice.

STOCK VACCINES

The writer has an open mind as to the relative values of autogenous and stock vaccine. That the latter is often of value in cases in which the autogenous product has failed is beyond question from any one who has done much of this work. Indeed, the whole theory of prophylactic immunization depends on this fact, so well exemplified in the case of typhoid fever. So far as it has gone, also, the vaccine treatment of ozena by a polyvalent stock vaccine has proved eminently satisfactory in the hands of Horn. It can readily be

seen how this may be so, if the suggestion of a basic protein common to all bacteria, or at least to associated groups, be accepted, giving at least partial immunity, and it is equally evident that it may fail in certain instances, notably the streptococcus group, since there are so many different varieties with widely separated characteristics and of greatly differing degrees of toxicity.

The subject of bacterial therapy is an absorbing one to most practitioners, and since commercial vaccines have been supplied in such quantities and made so readily obtainable, it has been used by thousands who doubtless understand little of the therapeutic action of the agent being used. Frequent warnings have been issued against the indiscriminate use of vaccines and the dangers attendant on their employment. The question is often asked whether under the circumstances a nonbacteriologist is justified in their use and if the danger is not greater than the chance of cure. The writer, while he formerly inclined toward this view, after having given several thousand injections in clinic and in private practice and being cognizant of as many more, has yet to see any more harm result from their use, even if not always intelligent, than from an equal number of ordinary hypodermic injections. One or two cases have been reported to him with somewhat severe reactions, alarming at the time, but this may happen with almost any form of therapy. Of course the claims of the makers of commercial vaccines are usually absurd and misleading, although it is surprising how many men of intelligence will accept them at times, even in the face of all reason.

SUMMARY

To summarize briefly, the writer feels that if vaccines have not fulfilled all of their early promise, they have at least given us a very effective extra means of combating infection, especially if used in conjunction with skilful and intelligent surgery; that little harm

will or can result from their use, even by the novice, provided the injections are given hypodermically, rather than intravenously, as in the latter method the reactions are at times exceedingly severe and alarming. In a number of instances, notably ozena, it seems as if vaccine therapy alone might solve a problem which has been puzzling clinicians hopelessly for years, and until some more efficient substitute is discovered, vaccine therapy has its distinct place as a therapeutic measure in diseases of the ear, nose and throat.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. DAVIS AND COATES

DR. DANIEL W. LAYMAN, Indianapolis: I have had some experience in the use of autogenous vaccines in the treatment of cases of chronic suppuration of the accessory sinuses. As far back as 1912-1913 I used the autogenous vaccine in the first group along with the regular routine treatment. In almost all of these cases we established thorough drainage by operative procedure, whether it was a conservative or radical case, and after the effects of the operation subsided we commenced this series of cases with autogenous vaccines, made both in the regular way and by animal experimentation. Most of these cases were of the staphylococcus type, *staphylococcus aureus* predominating. In the second group we used the autogenous vaccine without the necessary operative procedure. These patients refused nasal surgery and so I carried them along as well as I could with only the vaccine. Then in the third group of cases, just for comparison, I used the regular method of treatment without any vaccine whatsoever. I think that my results were about the same as Dr. Coates reports; that is, that the vaccine is a material aid in the treatment of chronic suppurative disease of the accessory sinuses along with the routine treatment and necessary nasal surgery. In other words, it is absolutely necessary to establish thorough drainage and ventilation, and that the vaccine therapy per se, that is without assistance of other treatment failed to be of any benefit as a therapeutic agent.

In the third group I used routine treatment and operative procedures when necessary, but without the aid of vaccines. Compared with the first group they did not do as well. In other words, I found that autogenous vaccine is a valuable aid in the treatment of chronic suppurative conditions of the sinuses where the treatment has been given to establish proper drainage and aeration of the sinuses. In regard to the treatment of acute rhinitis, I have not had any experience with autogenous vaccines, but I have had some experience with the stock vaccines. Two or three men who worked in a drug house came to me with bad colds in the head. They brought with them some stock vaccines and wanted me to try them out. I did so and got fairly good results. I did not use the stock vaccines during the acute attack, but waited until the acute attack was over and then gave the vaccine at three or four day intervals, about three or four doses altogether, increasing the strength from time to time. The treatment with stock vaccines of ordinary colds not only with the clerks as above mentioned, but with other patients, has been quite satisfactory.

DR. JOHN A. PRATT, Aurora, Ill.: I have been lucky in my vaccine cases. I have had very good results. I use both the autogenous and the stock vaccines. In cases where I do not have the time to make the autogenous vaccine, I have taken

the autogenous vaccine of other cases and mixed it with the stock vaccine and injected that. In that way I thought I would be able to obtain a vaccine of the local germ, of a local infection that was going round, and these cases have seemed to improve. Cases of sinus trouble have improved very rapidly in my hands with vaccines. It does not seem to make very much difference whether it is autogenous or stock. One case of tuberculous middle ear discharge ran a long time. She did not improve under the autogenous vaccine, and at that time an old gentleman came in who had a running ear for years, so I decided to try this woman's autogenous vaccine on the old man. I gave him three injections and the ear dried up and was cured. That was about five years ago. He was in my office before I came away and I asked him about his ear and looked at it, and it was perfectly dry. In the woman I had no improvement whatever. This possibly may be, as Dr. Davis indicates, leukocytosis, but I have seemingly had some results from the vaccines.

DR. DAVID JOHN DAVIS, Chicago: Many phases of this problem are unsatisfactory to discuss at the present time. We need more data and especially do we need control observations. It is remarkable how little control data exist in vaccine work. There is no doubt that reactions occur after vaccines and that good results have followed their use in some cases but the question centers around the idea of specificity. In other words, have these reactions a specific curative value? At present data is rapidly accumulating indicating the non-specific character of the results. It is an interesting fact that so far as animal diseases are concerned we do not know of any instance where vaccines are curative. This is in striking contrast to the rôle that vaccines play in animal diseases for prophylactic purposes. This is true of natural and experimental animal diseases. For example, Dr. J. J. Moore has shown that in rabbits already infected with streptococci, vaccines have no appreciable effect on the course of the infection. However, if the vaccines have been given some time previous to the inoculation the animal may be protected to some degree at least.

DR. GEORGE M. COATES, Philadelphia: Laboratory men and clinicians are very apt to differ, and it seems to me very necessary that they should get together more closely than they have in the past. Animal experiments prove a great deal from their standpoint, but it is only by using the results of these in combination with the work of the clinicians that we get ideas about the value of our methods of treatment. In regard to specificity, I always supposed that if we did not get results with the autogenous vaccines it was due to the fact that we did not have the specific organism. If this new theory is to be accepted it wipes that out—the stock vaccines will probably give as good results as the specific vaccines. We are at the beginning of this method of therapy, after all.

THE POSSIBILITIES AND LIMITATIONS OF NONSURGICAL BRONCHOSCOPIC TREATMENT

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GENERAL CONDITIONS OF PATIENTS REQUIRING BRON- CHOSCOPIC EXAMINATIONS

The patients and their conditions will vary as does the rainbow. They are usually those who have been treated from one month to a number of years by many different doctors. The majority are more or less emaciated, from the persistent cough and the knowledge of something wrong in their chest for which they have received no relief. Some are sent direct by their physicians; others, having developed the dispensary habit, going from one hospital to another, finally hear of your wonderful bronchoscope and through curiosity as much as the desire for a cure come into your hands. Dependent on the special condition of our patient, we find the general condition. Hence, the asthmatic with his barrel-shaped chest; the tubercular larynetic, with hoarse voice and almost continuous expectoration of frothy consistency; the hysterical, who seemingly imitates all or any one of the many symptoms of disease. Generally speaking, however, they are perfectly willing to undergo any examination or instrumentation, to have a correct diagnosis made with the possibility of a cure.

POSSIBILITIES OF DIAGNOSIS GREATER THAN BY OTHER MEANS

That the routine use of the bronchoscope is of invaluable advantage in obscure diagnosis is being demonstrated constantly. Tumors or growths outside of the

trachea or bronchial tube pressing and occluding the lumen are of frequent diagnostic occurrence. Calcareous deposits on the tracheal rings are as easily seen as though they were on the finger nails. False membrane of diphtheritic or other origin is found and removed with entire relief from the offending symptoms. Papilloma or other growths causing cough, dyspnea, reflex spasms of unwarranted severity, and either mechanically or clinically producing coughs, râles, expectorations, hemoptysis, malnutrition with greater susceptibility to other or all diseases are diagnosed and removed. Ulceration of various causes, tubercular or otherwise, are seen and medical agents applied. Strictures are dilated, asthma and tracheitis treated, all of these and many more are to us an open door through which we see many more possibilities in the future.

TREATMENT OF DISEASES AND CONDITIONS BY LOCAL MEANS

Tracheitis, or tracheal bronchitis, is one of the most frequent conditions we come in contact with. Like bronchial asthma, it appears in two forms: first, as highly inflamed or mucous-covered areas of mucosa, extending around the whole lumen of the bronchi, or as patches along its walls, varying in size from a large pinhead to from one half to an inch in length; second, we may find a dry condition, the secretions, if any, having formed hard crusts or scales of a dark or greenish hue. We are rather inclined to think the second condition is simply a later development of the first. It is within the realm of possibilities to follow the course of the disease from the original infection with the organisms producing the irritation, nature doing her part by sending leukocytes in abundance to stop the offending invasion; then tracing the outpouring of these through the mucosa with serum, constituting in this way secretion, with the corresponding tubular cough and expectoration. If resolution takes place, our patient is well; if not, the mucosa, as a

result of the drying of these secretions and the almost continuous cough, breaks down in places and ulcerations form.

The etiology is many sided. It may be due to the occupation as in the case of a stone or marble worker, or workmen breathing the fumes from iron molding or various vapors of acids; chauffeurs who drive continuously, inhaling quantities of dust. Bad hygienic surroundings may be the cause, or it may be produced by a condition of the upper air passages necessitating mouth breathing, in which we have lack of proper filtration, warmth or moistening of the inspired air; it may be due to sinus involvement, the continuous heavy bacteria laden discharge inflaming the pharynx and continuing by gravity or osmosis, finally reaching the larynx and trachea.

The treatment naturally divides itself into two methods: that appropriate for the first condition and that suitable for the second. We have found applications of glycerol-tannin, applied by tampons, to be the ideal treatment of the first division. These are to be used every other day, the whole lumen of the trachea or bronchi to be carefully gone over and painted. For the later development several therapeutic agents suggest themselves. We must first remove all incrustations, touching the underlying ulceration with silver nitrate, or other silver preparation, or a 10 per cent. alcoholic solution of iodine. The dry, reddened membrane responds best to stimulation by the ultraviolet ray. This is applied by means of a vacuum through the bronchoscopic tube, giving not more than one sixteenth inch spark at any time. As you are all aware, high frequency current is one of our most refractory agents, always wishing to go the long way to a given point instead of the short; and for this reason we have had considerable trouble in perfecting a properly insulated applicator for its use. The ultraviolet ray or spark when applied in this manner stimulates the mucosa to greater activity and acts as a

tonic to the underlying arterioles and nerve filaments, dilating the blood vessels to their proper caliber. I have stated the length of spark on account of the great number of electrical machines on the market, with their various ratings of voltage and amperage, thus confusing and complicating the treatment. The current acts in two ways, a one-thirty-second to a one-sixteenth-inch spark acting as a stimulant, whereas a larger, stronger spark is destructive in character.

Bronchial asthma can be traced, diagnosed and treated by bronchoscopic means in a surprising number of cases, although all available literature on the subject clouds the causative factor of this condition with many theories. If we expect to find the same clinical picture in all cases, we will fail utterly, for just as patients differ in all other characteristics, so their bronchial picture varies. As Jackson¹ has truly said, in order to get an accurate picture, it is necessary that the examination be done without any anesthesia, general or local, in at least one of the sittings with each patient, so that the bronchoscopic picture shall not be altered by the application of the anesthetic. The writer reported a case² the causative factor of which was a papilloma situated on the carina, and the removal of which gave immediate relief and permanent cure. Another case was found to have its exciting cause in quite a large ulceration between the second and third bifurcation on the right side; the treating and healing by bronchoscopic means was followed by entire relief of the patient's asthmatic attacks. In the majority of cases, however, we have found the mucosa of the trachea and bronchi red and swollen, here and there covered with stringy, mucilagenous secretion, the removal of which, in quite a number of cases, disclosed ulcerations. I have never seen, as Freudenthal³ records, the appearance of a scarlike mass obstructing the entire lumen of the bronchus, but have frequently

1. Jackson: *Pectoral Endoscopy and Laryngeal Surgery*, p. 478.

2. Ridpath, R. F.: *Laryngoscope*, 1914, xxiv, 942.

3. Freudenthal: *New York Med. Jour.*, June 24, 1911.

seen the lumen partially occluded by such masses. I would divide the cases of bronchial asthma into two general classes: those in which we have an inflamed, dry mucosa, which may or may not have a local lesion in the tubular air passage; and those in which the mucosa is inflamed and swollen, causing a lessening of the general lumen of the trachea or bronchi, and in which the secretion is copious; the primary factor may or may not be locally situated. Dr. James Adams has justly pointed out that asthma in most cases is essentially a toxemia and no treatment can be successful without recognition of this fact. If we take into consideration the many elements which may enter into the morbid anatomy of asthma, such as the nasal passages, alimentary tract, blood, urine, malformation and toxemia from scores of causes, we can readily see that the bronchoscopic appearance of the mucosa of the respiratory tubes also must vary according to the exciting factor. When all other possible causes have been eliminated and no apparent reason assigned, bronchoscopic treatment may be resorted to with numbers of cures reported.

Ephraim⁴ reports six patients cured, eleven improved and twelve not influenced by endobronchial treatment. He used a mixture of novocain, epinephrin, and normal salt solution, later reporting 133 patients treated with a spray of epinephrin and novocain with excellent results. Greenwald⁵ reports good results following repeated applications of 1 to 10,000 epinephrin.

Personally, in the treatment of the conditions described in the first division, I proceed as follows: If the trachea is dry or inflamed, the proper treatment is to build up the mucosa as any other mucous membrane in the same condition. We first relieve the congested arterioles of the excessive blood by spraying with 1 to 5,000 or 1 to 10,000 epinephrin in normal

4. Ephraim: *Monatschr. f. Ohrens.*, 1913.

5. Greenwald: *München. med. Wchnschr.*, 1913.

salt solution, after which may be applied by local tampons equal parts of compounded tincture of ben-zoin and boro-glycerid; or a silver solution, or a spray of pure liquid petrolatum with 1 per cent. ichthyol applied to all diseased areas. This should be repeated in three days and continued at that interval for five or six times to note any effect. If the case is one of the second variety, the secretions must be removed by vacuum, all masses of mucus removed, the ulcers treated with silver nitrate 10 per cent., and a local application of glycerio-tannin to the mucosa. This should be repeated twice weekly.

Papilloma of the larynx in children occurs in two forms. In one form the growth disappears spontaneously, in the other, surgical or other means are required. That papilloma occurring in children is more frequently cured spontaneously there can be no question. Of those patients requiring treatment, I am permitted in this paper to speak only of other than surgical means, of which there are four methods of treatment: (1) fulguration, (2) radium, (3) Roentgen radiotherapy, and (4) medicinal agents.

Fulguration by means of high frequency current is unquestionably a curative agent to be considered in this condition and if persisted in for several treatments will effect a cure; the only disadvantage exists in the growths which lie under the cord, their position being almost inaccessible for fulguration treatment. Harmon Smith⁶ reports exceedingly satisfactory results by this means.

Radium in every case thus far reported has not only affected a cure, but seemingly prevents recurrence.

Roentgen radiotherapy has never been used to any great extent, but should have a curative effect if properly given. I am rather inclined to believe that a series of applications of the Roentgen rays will limit the frequency of return in those cases which have had operative treatment.

6. Smith, Harmon: *Laryngoscope*, 1913, xxiii, 1029.

Delevan uses applications of alcohol, starting with a 50 per cent solution and increasing the strength as the treatment progresses. We must, however, be exceedingly careful not to have the applicator dripping. E. L. Jones has had excellent results from a saturated solution of salicylic acid in alcohol.

I have used fresh pineapple juice in one case with entire destruction of the growth, the action of the juice seemingly to shrivel the papilloma; the only disadvantage is in the number of applications necessary, requiring a dozen or more. I do not think tracheotomy is necessary before using any of these applications, but all medication must be applied direct to the papilloma and not indiscriminately to any and all of the laryngeal mucosa. Papillomas in adults are on the whole more amenable to treatment than similar growths in children and decidedly less liable to return.

It is also well to remember that benign growths proliferate on the surface and do not infiltrate.

The significance of tuberculosis of the larynx, trachea and bronchi is too well known and appreciated by the profession to need emphasis or repetition. With the aid, however, of bronchoscopic methods more light and quicker diagnosis and treatment are made possible. In practically all literature obtainable tuberculosis of the larynx and trachea are considered secondary to pulmonary involvement, and yet case after case coming under my care, when examined bronchoscopically have both clinically and microscopically been diagnosed tuberculosis without showing any pulmonary lesions, either clinically or by means of Roentgen-ray examination. Granting that the lung tissue is possibly better soil for the growth of the bacillus and the trachea and larynx become involved secondarily, I am unable to see any reason why the interarytenoid tissue, the cartilages or the mucous membrane could not be primarily infected, extension and invasion of the lung tissue taking place secondarily.

Dr. George Wood in his admirable article has clearly demonstrated the frequent involvement of the tonsils with tubercle bacilli, also that the tonsils act as a portal of entry for the disease into other portions of the body.

As the tonsil is so frequently involved, it does not require such a vivid imagination to reason that the same infection might, and does, occur primarily in the larynx and trachea; the only reason of our inability to properly diagnose the cases has been due to ourselves, and the close simulation of beginning tubercular laryngeal inflammation to simple acute or chronic laryngitis.

With the routine use of the bronchoscope, I believe that another era has dawned for diagnosing and treating tuberculosis in its incipency. According to Casselberry⁷ one of the earliest and most destructive of the initial tubercular changes in the larynx and one which may precede by years any more active development is the mammillated hyperplasia commencing at or near the subglottic portion of the base of the vocal process and gradually marked by a furrow in the vocal angle. This later ulcerates into vaguely outlined margins with mouse eaten edges, their base covered with granulation tissue. Infiltration and edema may now occur with extension of the disease. St. Clair Thomson reports 50 per cent. of those who die from tuberculosis show laryngeal involvement at postmortem examination, and further states that in ninety-nine out of 178 patients with laryngeal tuberculosis treated in the past three years, the disease was either arrested or improved. Brull reports 58 per cent. of the patients clinically cured and of these, 31 per cent. remained cured. While the local treatment for this condition affecting the epiglottis and larynx can be pursued by the direct bronchoscopic method, the suspension

7. Casselberry: Infective Lymphoid Growths of the Laryngopharynx, Secondary to Sinus Suppuration, *THE JOURNAL A. M. A.*, Feb. 13, 1915, p. 576.

laryngoscope of Killian or Lynch is much to be preferred, affording the operator both hands free and close range examination. The treatment is to destroy the local lesion either by surgical means, with the curet or by electrically or medicinally cauterizing the area. Patients must be cautioned about the resulting edema from these treatments and instructed of its dangers. I would suggest to treat only a small portion of the infection at one sitting, thereby reducing the danger from edema. If the ulceration occurs in the trachea or bronchial tree, cauterization may be done by beaded chromic acid or trichloroacetic acid.

Catarrhal hypertrophies of the mucosa appear as swollen, inflamed, spongy areas extending into the lumen of the trachea or bronchi and lessening its diameter. The secretion is usually found to be very tenacious and hard to remove. The treatment varies with the condition present, from the use of glycerotannin, or a 2 per cent. solution of silver nitrate, to the application to the swollen areas of chromic acid, used as a bead on an applicator.

Bleeding from any of the arterioles of the mucosa is easily seen. It may originate from a tuberculous lesion, malignancy or aneurism and the treatment should be instituted according to the condition.

Stricture or stenosis of the trachea or bronchi occurs mainly from outside sources. Goiters, enlarged thymus, tumors of the esophagus, mediastinal or thoracic tumors and aneurism may produce it, and with removal or treatment of the original cause we have a decrease or a cure of the stenosis.

Syphilis of the tracheobronchial tree may also occur. In spite of the frequent involvement of syphilitic lesions in the larynx, the finding of lesions in the lower air passages is a rarity. These lesions may be inflammatory, ulcerative or gummatous. A therapeutic or Wassermann test is, however, necessary for confirmation and exclusion of tuberculosis.

For vocal nodules, Wylie recommends very highly the use of the galvanocautery point. Great care, however, must be employed in its use. A saturated solution of magnesium sulphate repeated every other day or very small applications with trichloroacetic acid will practically always give us the desired curve.

Cystomas, according to Jackson, have been known to be cured after galvanopuncture, but he also states that we must be sure to destroy the sac.

LIMITATIONS

As all procedures must necessarily have their limitations, so we meet with finitude in bronchoscopy. Patients with valvular heart disease, those having any cardiac lesions with failure of compensation, are practically barred from a bronchoscopic examination, first, because of the excitement caused by the examination, and second, by their inability to stand the local anesthesia. Patients with long-standing cases of asthma, with the typical barrel-shaped chest and the abdominal breathing, more or less constant cough, dyspnea, thick tenacious mucus and expectoration do not stand the examination well even if the tube can be passed at all. They are also very susceptible to cocaine and the examination of these patients is almost impossible without its use on account of the chronic inflammation of the membrane. People with short, thick necks with their inability to flex the head on the back of the neck are numbered among the class of bronchoscopic impossibilities. Arthritis occurring in any vertebral articulation precludes examining the trachea. In serious cases of dyspnea the application of cocaine with the instrumentation would be extremely dangerous. Dyspnea may increase if the larynx is stenotic before operation, necessitating tracheotomy. Ankylosed jaws naturally would make an examination impossible. Aneurism might not only produce pressure, with a corresponding convexity to the tracheal circumference, but with the increased blood pressure

accompanying it. This condition demands great caution, not to speak of the danger of rupturing the aneurism, an accident which occurred in one of Collier's cases. Apoplexy and arteriosclerosis are contraindications. Goiter if of sufficient size to press on the tracheal rings or cartilages will be sufficient mechanical obstruction to limit an examination. Idiosyncrasy to cocain may induce toxic syncope. Serious hemorrhage could occur only in a hemophiliac.

THE POSSIBILITIES AND LIMITATIONS OF SUSPENSION LARYNGOSCOPY

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Suspension laryngoscopy as a procedure is so new that the proverbial pendulum has hardly begun to swing in either direction. In the first place, are you entirely satisfied with the instruments as they are shown to you at this time? Is it probable that the last word has been spoken in this regard? I may answer this by saying that I am constantly looking for a more simple instrument than the one I have been using.

It would seem that the mechanics involved is on a sound foundation and the principle as proposed by Killian is faultless, yet modern ingenuity may change our method considerably.

As we view it today, suspension laryngoscopy is not to be practiced successfully with any instrument designed primarily to sell for \$10. The act of suspension is not a simple, safe operation and if we elect to suspend our patient with an instrument that is flimsy, fragile and too dainty to bear the burden, you will lay your patient open to the possibility of a serious termination and yourself to criminal negligence.

You must bear in mind that in order to convert the curved road from the teeth to the vocal cords, with the mouth wide open, into a straight path, there is required a considerable amount of power and a certain amount of muscle relaxation, the one bearing a direct proportion to the other; and in addition must be considered the possible variations in normal anatomy designed apparently to defeat your purpose.

This means that one must use more power than the uninitiated realizes and must apply this in a manner

that is perfectly safe in its every detail. There are required rigid, strong, well-built instruments, which will withstand any strain to which they are subjected.

It is an easy matter to view the larynx through a Jackson or Mosher spatula, and the application of either model in trained hands is practical without pain or danger to the patient, and not uncomfortable to the operator. In the use of this, however, one hand is busy with the spatula, and whatever further is done must be accomplished through a closed or split tube.

With suspension the chief advantage is in seeing the parts in their entirety through a wide-open mouth and in obtaining a view limited only by the boundaries of nature, with no part of the instrument in the field, and with both hands free to work as the indications require. One examines more minutely and by direct vision selected areas, using one or both hands to acquire the view. One sees plainly before him the entire interior of the oral cavity, the mesopharyngeal and hypopharyngeal spaces, the mouth of the esophagus, and the posterior and interior aspects of the larynx and trachea by such a broad view as is impossible to acquire by any other means. For instance, to look into the ventricles of the larynx either by my tilting mirror or directly, or to see the inferior surface of the vocal cords, either by a mirror placed below them or by actually lifting the cord so as to bring the under surface into view is a possibility under suspension only.

To study the larynx in health and disease by the tactile sense is an entirely new experience in this field. For one who has been trained in the old school of mirror, tongue napkin, applicator or forceps to be permitted to sit before his patient with the larynx entirely exposed in such a manner that no part will be lost sight of; to view each detail carefully, slowly and deliberately and to have the perfect assurance that nothing that the patient can do will in any way alter or disturb the view; then to proceed deliberately to study each detail by the sense of touch and sight combined;

to palpate tumor masses ; to feel the extent, character and depth of ulcerated and indurated areas ; to determine the progress of proliferating, inflammatory and new growth formations ; to study the muscular movements of the vocal cords during respiration and phonation and to search the nooks and corners for evidence of disease, must awaken in him a sense of delight and satisfaction similar to that experienced by the skilled diagnostician who palpates a stone or abscess in the pelvis of the kidney or an aneurysm of the common iliac artery, or a gynecologist who recognizes an early extra-uterine pregnancy.

Now, to proceed further and to remove by dissection a tumor or cyst growing from any locality in the same manner and with the same instruments, slightly modified, as the general surgeon would select to remove a similar mass from the skin surface ; to pass a bronchoscope between the vocal cords down into the trachea of an infant or young child ; to remove a foreign body from the trachea by means of forceps unaided ; to curet and cauterize ulcerated areas accurately without danger of injuring the normal structures surrounding the field of operation ; to do a plastic operation on a selected part and to be able accurately to place stitches when and where needed ; to introduce the esophagoscope or to remove from any area within the field of view a specimen of tissue for the microscope — these briefly are some of the present possibilities of suspension laryngoscopy.

It must be borne in mind that the suspension apparatus is not intended as an instrument for ordinary office examination, nor is it to be used when one wishes merely to see the lingual tonsil or the mouth of the esophagus, nor will it ever replace the use of the bronchoscope or esophagoscope. In fact, it is not intended to replace the ordinary throat mirror or the various direct spatulas or the tubes. Its field of usefulness is, as I have tried to outline, separate and distinct from all other methods known to us.

One acquires skill in its use with a little practice, but like all delicate manipulations, a certain amount of continuous practice is essential to best results. For this reason if one has but a limited field or a small clinical service in which facilities are limited, the suspension will not be a valuable addition. It is not intended for use in makeshift, impromptu operating rooms, with kitchen tables, ironing boards and the like for equipment.

Filmsy mouth gags with sliding tongue plates, having a handle and hook attached, will not replace the carefully constructed instruments presented to you by Kilian and myself. So long as the principles involved remain as we now consider them, this type of instrument can yield nothing but failure to you and throw discredit on the procedure, so I caution you against them as a class.

Fixed cervical vertebrae throwing the chin near the sternum or any other similar deformity which would render it physically impossible to open the mouth or convert the curve into a straight line would contraindicate the use of the apparatus.

A large epithelioma at the base of the tongue with cervical gland involved and one or both pillars of the pharynx indurated would likewise contraindicate its use.

In those cases in which thyrotomy and low tracheotomy have been done in persons with long necks, if the larynx seems to drop lower into the chest cavity than the normal and the resulting scar from previous operations limits the free extension of the chin, I have found it impossible to see by suspension any more than the posterior aspects of the arytenoid cartilages.

Lastly, one has the privilege of discretion in the selection of his subjects for suspension, and this he is expected to practice at all times and with due regard for patient and apparatus alike.

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MECHANICAL PROBLEMS OF BRONCHOSCOPIC AND ESOPHAGOSCOPIC FOREIGN BODY EXTRACTION

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In dealing endoscopically with foreign bodies lodged in the larynx, trachea, bronchi or esophagus, it is fundamentally necessary to remember that the problem is not simply to remove the foreign body but to remove it with little or no risk to the patient. It is always necessary to remember that a patient is far safer with a foreign body in his air or food passages than he would be if the intruder were ruthlessly torn out at all hazards. Ruthless withdrawal is comparable to the act of the ignorant farmer who hitches a team of horses to the malpresented calf. Only in the rarest instances is immediate removal necessary, and it is far better to desist at once if at the first bronchoscopy it is found that special instruments will need to be devised to remove the intruder. On the other hand, it is never wise to make the first bronchoscopy without having prepared beforehand everything that can possibly be needed, so far as it is possible to foresee from a study of the roentgenogram, history, symptoms and physical signs.

The experience resulting from the encounter with foreign bodies of almost all conceivable shapes and substances has resulted in an armamentarium which probably can deal with all kinds of foreign bodies. When the bronchoscopist first catches sight of a foreign body for which he has been searching, the temptation to seize it by whatever part is visible and to pull on it with all the strength of which his forceps are capable is very great; and one might say that the

temptation is greater directly as the duration of the search. Yielding to this temptation has been the cause of more mortality in foreign-body bronchoscopy and esophagoscopy than any other single factor. Moreover, hasty, injudicious traction of this kind will very often not only fail to remove the foreign body but will so complicate the situation as to render subsequent removal exceedingly difficult. In other words, the mechanical problem is converted from a very simple into a very complicated one, just as pulling on a tangled mass of string will render subsequent disentanglement difficult or impossible. Therefore, it may be stated that there are three reasons why the study of the mechanical problems of foreign-body extraction constitute the most important study in foreign-body endoscopy. These three reasons are:

1. Attempted endoscopic removal of a foreign body by seizure on any presenting part, followed by traction without proper study of the mechanical problem, ends in a high percentage of mortality.
2. Such attempts frequently fail to remove the foreign body.
3. Such attempts frequently complicate the problem so as to render subsequent removal exceedingly difficult, converting an easy problem into a difficult one, or even into one impossible of endoscopic solution.

The following considerations of solutions of mechanical problems are based on the successful endoscopic removal of foreign bodies from the esophagus, larynx, trachea and bronchi, in 543 out of 550 cases (98.7 per cent.). In the 550 cases, seven patients (1.3 per cent.) died within a week. In six of these the patient was in bad condition when admitted. In only one of the seven could the death be attributed directly to the bronchoscopy. The parents refused to allow a post-mortem, so the cause of death could not be determined. In a large proportion of the 543 successful cases, removal had previously been unsuccessfully attempted

by others. That success attended the efforts of Dr. Patterson and myself was due not to greater skill, nor to superior instruments, but rather to the careful study of the mechanical problems involved and to the avoidance of the dangers hereinafter pointed out. Some of the previously described solutions of mechanical problems are merely mentioned in connection with later statistics which confirmed the value of the methods. There is much overlapping of the groups of statistics because of many cases presenting a combination of two or more problems, each of which was separately solved according to its class.

The Advantages of Small Tubes.—In the solution of mechanical problems of foreign-body extraction, the advantages of small tubes are not generally realized. For general purposes, such as the diagnosis of disease, finding of a small foreign body without risk of overriding, etc., the largest possible tube has great advantages; but in the working out of difficult problems of endoscopic foreign-body extractions, the small tube has advantages that make all the difference between success and failure. As will be seen in Figure 11, a tube (*A*) that fills the entire lumen of the esophagus or bronchus has no lateral range of motion, while a relatively small tube (*B*) has a very useful range of movement. The value of this lateral movement is realized when it is remembered that endoscopic tubes are rigid, whereas endoscopic instruments other than tubes are necessarily long and slender; hence the distal ends are not susceptible of a useful degree lateral movement. The forceps *C* cannot be moved with any useful degree of control from *D* to *E*, whereas the forceps *F* can be energetically moved from *G* to *H*, by lateral movement of the tube, *B*, because of the smallness of the endoscopic tube, *B*, relative to the esophagus, bronchus or trachea, as the case may be. We may say, then, that forceps in a large tube have no useful lateral range of movement, while tubes small in diameter relative to the diameter of the esophagus or bronchus have a

lateral range of movement that is in some cases indispensable to success.

Motion of Foreign Bodies in the Bronchi.—An important factor which must be always in the mind of the endoscopist in working out the solution of a mechanical problem of foreign-body extraction is that the foreign body is never still a moment. The movements are bechic, respiratory and pulsatory. All of these movements in many cases greatly increase the difficulties of removal; in other cases the movements can be taken advantage of to assist the bronchoscopist. An instance of the latter may be cited in the case of a long foreign body, such as a pin, completely hidden in a small bronchus into which the bronchoscope cannot enter, but from which the point of the pin may be protruded during bechic, respiratory or pulsatory movement (Fig. 10). More often, however, these movements are a great hindrance, not only by the fact that they keep the foreign body in motion, but that they all tend to bury the point of sharp pointed objects. The respiratory and pulsatory movements are really in many planes, but the chief movements noticed by the bronchoscopist in all cases of foreign bodies in the larger bronchi is the to-and-fro motion toward and from the bronchoscope, chiefly in the bronchoscopic axis. Advantage can be taken of this movement so to place the bronchoscope that the point of a pointed foreign body may enter the tube mouth. In doing this it is very necessary to remember that the recession of the foreign body will withdraw the point out of the tube mouth unless the tube mouth is, at the proper moment, inserted far enough down over the foreign body. This maneuver concerns foreign bodies whose points are free when first approached or have been freed as the first stage of the solution of the mechanical problem. In addition to the more or less axial movement of the foreign body there are also a number of lateral movements, though these may be more or less hindered by some degree of opposition on the part of the bronchoscope.

Dr. George C. Johnston thus describes the various movements as seen fluoroscopically in a case of the author (Figs. 1 and 2):

The foreign body, which is 1 cm. in diameter by 3 cm. in length, is observed to be in constant motion. The foreign body was seen to move 2 cm. up and down at each excursion of the diaphragm. The excursions of the foreign body are downward and outward, upward and inward. In addition there is a constant lateral motion of the foreign body synchronous with the cardiac impulse. The foreign body is never at rest. The least amount of motion is found at the instant of full inspiration.

These movements I have endeavored to represent schematically in Figure 3. They are represented in one plane only. It is necessary to remember that there is a similar movement, though of less excursion, in many other planes.

PROCEDURE

The various steps in the solution of the various mechanical problems of foreign-body extraction, as practiced in the author's clinic, are as follows:

1. Roentgenographic study.
2. Preliminary working out of a mechanical problem, based on the probabilities as deduced from the Roentgenographic study.
3. Endoscopic study.

Roentgenographic Study of Mechanical Problems of Endoscopic Foreign-Body Extraction.—The marvelous advances in roentgenography have wonderfully simplified the solution of mechanical problems of the disimpaction and removal of foreign bodies. The roentgenologist now usually produces a roentgenogram which shows not only the foreign body but sufficient outlines of the bronchi to enable the endoscopist to formulate a plan of disimpaction and removal that will be correctly based, according to the experience in the author's clinic, in about two thirds of all cases in which the foreign body is opaque to the ray. In case of foreign bodies not opaque to the ray, their presence can often be determined almost certainly from the visi-

ble pathologic sequelae; yet this does not aid in the solution of the mechanical problem further than to indicate in certain instances (Fig. 5) that complete obstruction of a bronchus means a tightly fitting, cork-like impaction of the foreign body in the invaded bronchus. In all cases roentgenographic study should include an anteroposterior and a lateral roentgenogram. In some instances aid will also be obtained from a roentgenogram taken in the quartering lateral position, but in no instance should this take the place of the lateral, and in any case great care is necessary to prevent the quartering roentgenogram from confusing the endoscopist's mental conception of the position of the foreign body as gained from the anteroposterior and the lateral roentgenogram, taken as nearly as possible on planes perpendicular to each other. Fluoroscopy cannot take the place of a roentgenogram, because, as a rule, the trachea and main bronchi cannot be seen on the fluoroscopic screen; and many bodies of borderline opacity are visible roentgenographically though invisible fluoroscopically.

P rearranged Plan.—Given good lateral and anteroposterior roentgenograms showing the size, shape and position of the foreign body, a knowledge of the duration of the sojourn, and a previous experience with a similar foreign body, a preliminary plan of extraction can be worked out, and in most cases such a plan will be found successful. If, however, the intruder has been injudiciously pulled on, preliminary plans are usually useless; nothing but local endoscopic study will avail.

Endoscopic Study.—The region of the foreign body should be approached carefully so that the tube mouth or secretion swabs shall not touch the foreign body until after the size, shape and, particularly, the position of the intruder relative to the bronchial wall, are studied. Careless swabbing may force the foreign body downward. In the larynx, to justify an endoscopic study before seizing the foreign body, the patient must

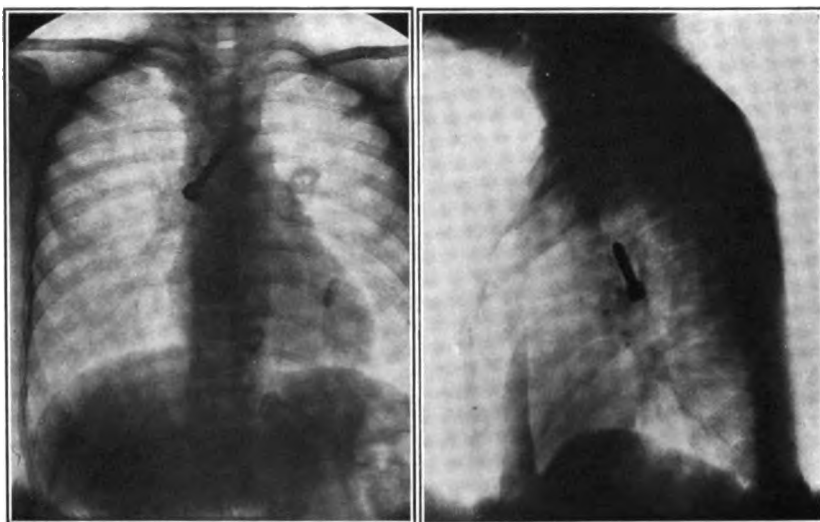


Fig. 1.—Roentgenogram showing an iron casting in the right bronchus of a child of 8 years. The movements of the casting are shown in Figure 3. Foreign body removed by peroral bronchoscopy without anesthesia.



Fig. 2.—Iron casting (actual size) from a blind-roller shown in Figure 1. The hard, smooth conoidal end, presenting in a tightly fitting ring of swollen mucosa, rendered difficult the finally accomplished seizure of the stem below the conoidal end.

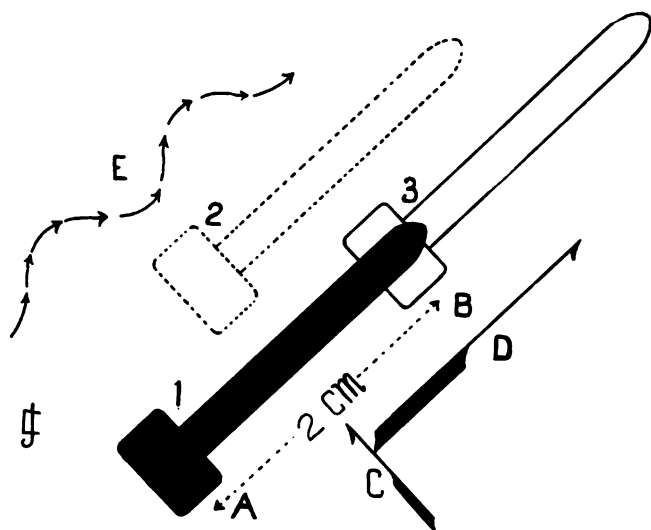


Fig. 3.—Schema illustrating the normal respiratory and pulsatory movement of the bronchi along with bodies contained therein. There is also, in case of bodies free to move, a movement of the foreign body with relation to the invaded bronchus, during cough, respiration, etc.

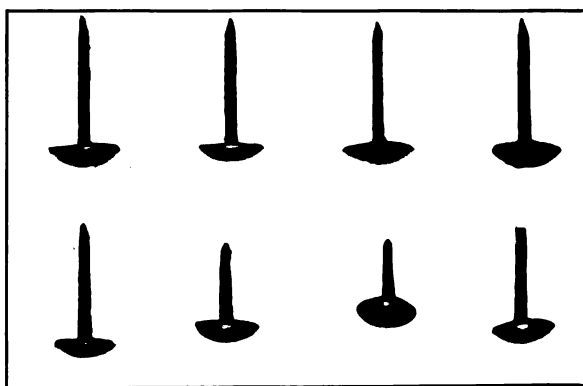


Fig. 4.—Upholstery tacks from the bronchi (eight cases). The removal of these presented the mechanical problem of the mushroom anchor.

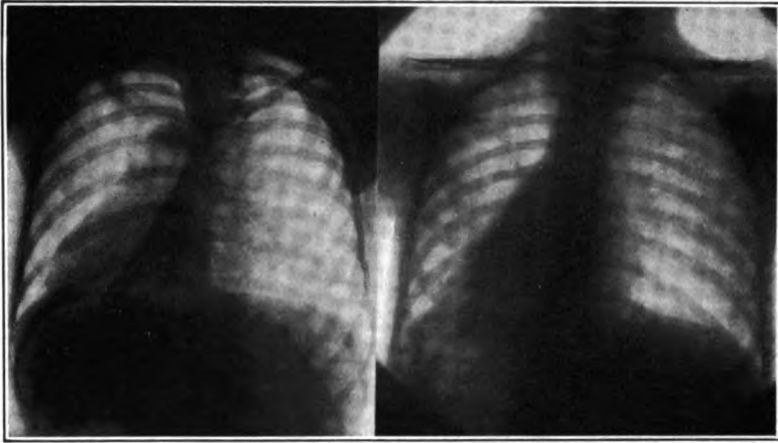


Fig. 5.—Roentgenogram showing obstruction of the left inferior lobe bronchus, by a Greek peanut (pistachio) shell, in a girl of 8 years. When such a shadow is seen we may know that we shall have to deal with a foreign body fitting tightly and corklike in a bronchus. There is shown compensatory emphysema of the right lung and also of the left upper lobe. The right-hand roentgenogram shows the disappearance of the triangular shadow after the removal of the pus and the obstructing foreign body, by bronchoscopy, without anesthesia, general or local. (Plate made by Drs. Johnston and Grier. Author's case.)



Fig. 6.—Shell of pistachio nut removed by peroral bronchoscopy without anesthesia. The broad surface was found presenting, requiring version to present an edge for seizure.

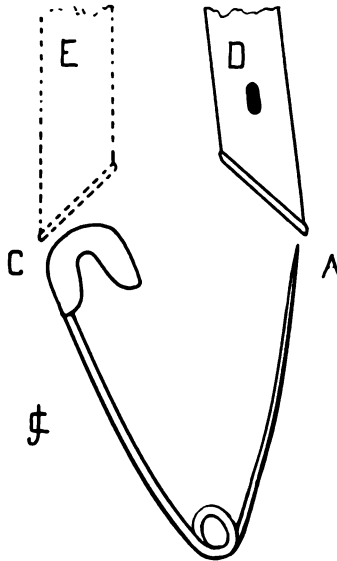


Fig. 7.—The problem of the safety pin. Twenty-seven safety pins have been endoscopically removed from the larynx, trachea, bronchi and esophagus, in the author's clinic, by this and other peroral endoscopic methods.

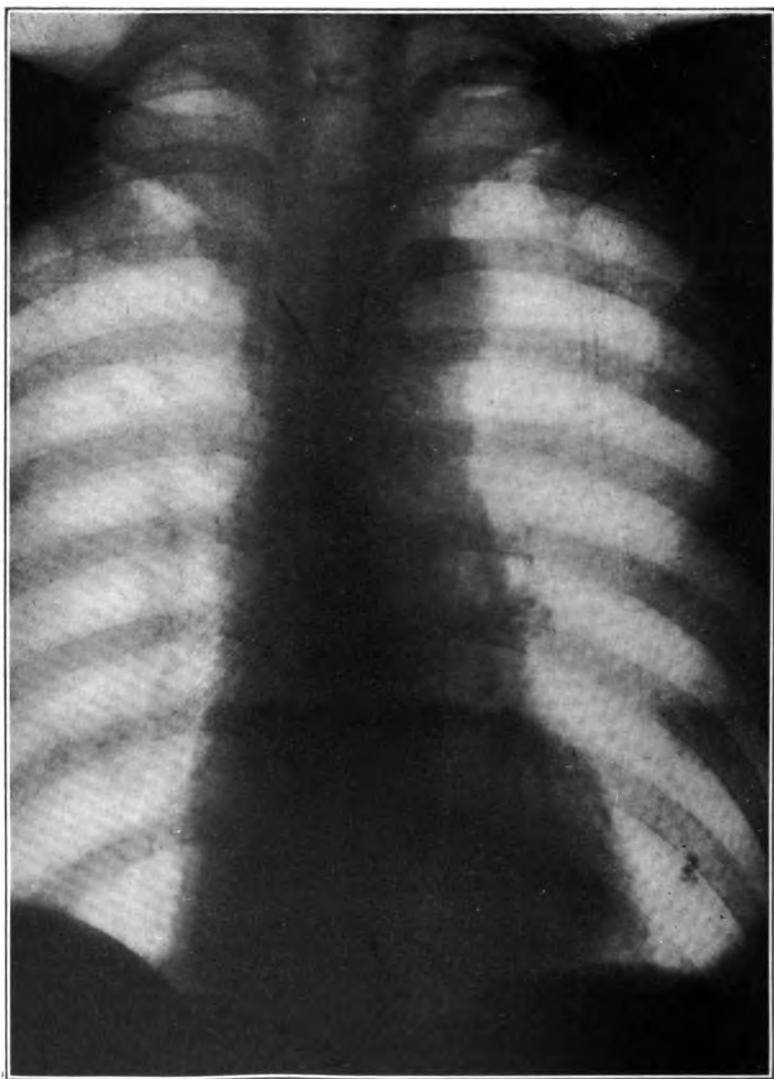


Fig. 8.—Roentgenogram showing a bit of wire from an egg beater in the esophagus, where it had lodged while the patient was eating custard pie. The hooked ends do not show because the bends are in the sagittal plane.



Fig. 9.—Wire removed by peroral esophagoscopy from the esophagus of a woman, aged 57 years. Removed by peroral esophagoscopy without anesthesia, general or local. The object is turned partly edgewise to show the hook-shaped ends, which presented the great difficulty in removal.

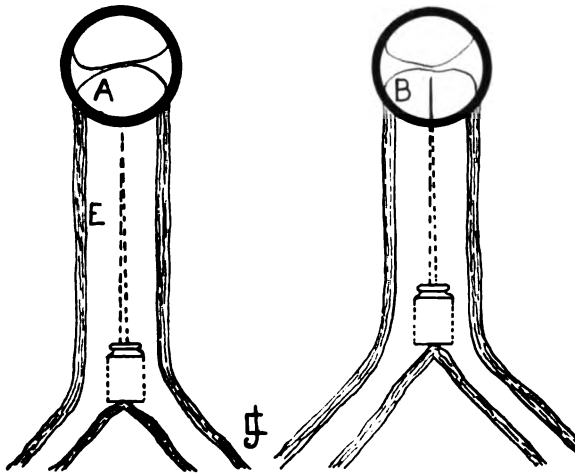


Fig. 10.—Schematic illustration of bechic aid in revealing a foreign body in a bronchus. The dental instrument, *E*, was entirely contained in a small branch bronchus so as to be entirely invisible to the bronchoscopist looking down the stem bronchus, *A*. When the patient coughed, the altered position of the bronchi caused the point of the dental instrument to emerge into the lumen of the stem bronchus as shown at *B*, whence it was easy to remove with forceps.

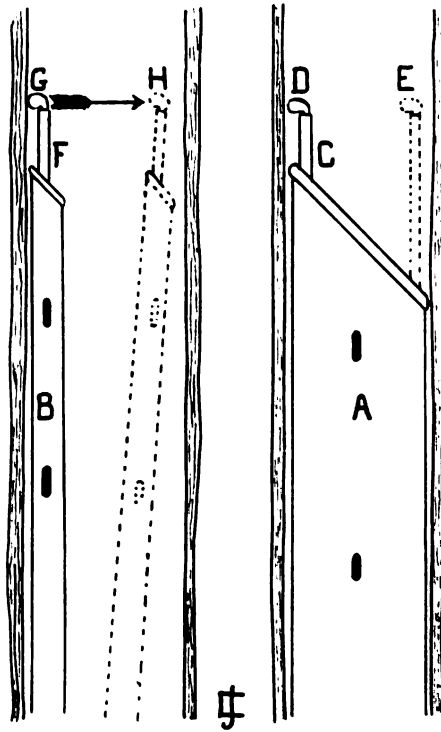


Fig. 11.—Schema showing advantage obtainable by the use of tubes of relatively small diameter. Sidewise movements of forceps can be executed with a small tube, *B*, that are impossible with a tube of large relative diameter, because the thin flexible forceps, incapable of lateral movement, can be forced sidewise by the rigid endoscopic tube if the latter is of relatively small diameter.

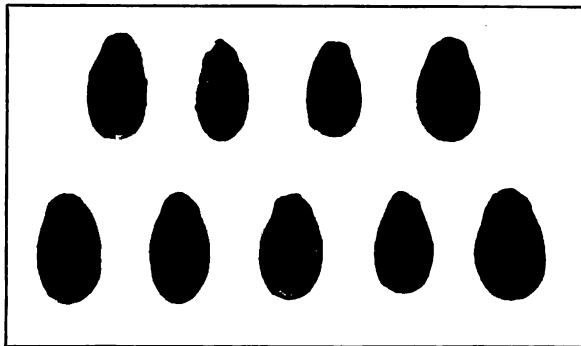


Fig. 12.—Watermelon seeds removed from the bronchi of children (9 cases), by peroral bronchoscopy, without anesthesia, general or local. Some of these required version so as to present an edge for the grasp of the forceps.

be in the author's "low head" position, so that if dislodged the intruder will not drop downward into the deeper air passages. In using this position the author has a number of times released and regripped a foreign body in the work of disengaging the point or otherwise solving the mechanical problem of removal of the foreign body with the least possible trauma.

MECHANICAL PROBLEMS

Objects Presenting a Thick Conical End.—These often present great difficulty of grasping because the forceps are prone to slip both sidewise and longitudinally. Forceps whose jaws are slightly cup-shaped have less tendency to slip sidewise; and those with properly made teeth will usually hold if the jaws are sufficiently far down on the object, as for instance was done in case of the foreign body illustrated in Figure 2. This is not often easy to do in case of thick foreign bodies because the proximity of the bronchial walls prevents proper expansion of the forceps' jaws. This difficulty is much increased if the intruder has been in situ sufficiently long to permit of swelling of the superjacent bronchial mucosa; and the difficulties may be enormously increased by trauma of previous attempts.

Irregular Objects.—These frequently present in such a way that they require turning so as to present a favorable surface for the grasp of the forceps. For instance, the peanut (pistachio) shell (Figs. 5 and 6) presented its concavity toward the tube mouth. The shell was turned so as to present its edge for the grasp of the forceps. Watermelon seeds (Fig. 12) in many cases require to be thus turned. Version is one of the most frequently required procedures in the solution of endoscopic mechanical problems.

Sharp Pointed Bodies.—All sharp-pointed, more or less straight bodies, such as needles, pins, nails, tacks, etc., have strong tendencies (1) to become embedded at the point; (2) to become transfixated crosswise, and (3) to work lower and lower into the air passages by

a ratchet-like action. The mechanical problems of their removal have been elsewhere gone into quite extensively by the author and need not be reconsidered here. In general, however, it may be stated that the pulling on such bodies almost invariably results in crosswise fixation or fatal laceration of the bronchi, with failure to remove. In all cases the position of the foreign body should be carefully studied with a view to getting the point disimpacted and into the tube mouth before any traction whatever is made. Quite frequently the disengaging of the point requires the pushing of the foreign body downward so as to withdraw the point from the wall in which it is embedded by bechic efforts at expulsion in the case of the air passages, and by the pressure of food in swallowing in the case of the esophagus.

Transfixed Foreign Bodies.—Both points being embedded, these bodies usually require very careful handling; otherwise attempted removal will be quickly fatal. They are quickly and safely dealt with by the methods elsewhere described, which have been uniformly successful in sixty-four cases. Many of the cases presented other problems in addition to the problem of transfixion.

Safety Pins, Open, and Point Upward.—The most important utilization of the roentgenographic study is for the endoscopist to get a mental picture of the position of the foreign body with reference to the approach of the endoscopic tube. For instance, if the esophagoscopic tube is allowed to approach the foreign body without any previous study of the problem, it will usually, in the case of safety pins, present to view first the keeper end of the pin as shown at E, C, Figure 7. If, however, the endoscopist from previous study knows that the point A is, for instance, outward to the left, he bears in that direction with his tube mouth, as shown at D, with the result of bringing into view the point, A, or, if this is buried, the shank of the pointed end as near as possible to the point. This

enables the endoscopist to solve the safety pin problem in one of the simplest ways, by seizing the pointed end of the pin, *A*, drawing it within the tube mouth, when traction will be relatively safe, as compared to traction on the end, *C*, which will almost invariably prove fatal from perforation of the esophagus, by the point, *A*. Practically the same problem is presented when a safety pin has lodged in a bronchus, especially if, as in one of the author's cases, the point, *A*, had entered far into a lateral branch. In one of the author's cases, the safety pin had lodged in the right bronchus with the point of the pin projecting into the right upper lobe bronchus completely hiding from view all of the shank, *A*. The problem was solved by closing the pin by use of the well-known tilting ring and push fork instrument. In case of esophageally lodged safety pins, the best method in the author's experience has been the one that in the Pittsburgh clinic is called "endogastric version." We have had altogether 27 cases of safety pins, 16 being in the esophagus, 2 in the trachea, 1 in the bronchus, and 8 in the larynx. Of the esophageal cases 5 were closed before removal, 4 were removed by protecting the points with the tube mouth (Fig. 7), and 7 were removed by endogastric version. All of the patients were discharged cured. Our "follow up" system discovered that in one case the child was taken suddenly ill about ten days after leaving the hospital, and died, the exact cause of death not being determined. In this case the pharynx and larynx had been found, at esophagoscopy, to have been very badly lacerated from the attempts of the parents with their fingers to remove the safety pin. The esophagus showed trauma caused by blind efforts with forceps and bougie before coming into the clinic. No postmortem was made.

Upholstery Tacks.—These (Fig. 4) usually lie point upward with the head buried in swollen mucosa, presenting the "mushroom anchor" problem, the solution of which has been elsewhere described. It may be

stated that our recent cases have brought the total up to eight cases.

Double-Pointed Tack.—One of the most difficult problems to solve is that of the double-pointed tack, the points being upward and buried in the swollen mucosa. In the esophagus the most serviceable method is that of endogastric version, as with safety pins. In the air passages version is much more difficult, but can be accomplished by very patient work. The technic has been previously described.¹ We have had six cases of fence staples. Two were in the trachea, one in the right bronchus, one in the left bronchus, and two in the esophagus. All of these were removed by endoscopic version. Five patients made a prompt and uneventful recovery. One patient, who had been subjected to ill advised traction previous to admission, was suffering with a mediastinal emphysema, which rapidly proved fatal. In another case a double pointed tack escaped into the pleura, whence it was removed by external operation.

Hook-Shaped Bodies.—Hook-shaped bodies, such as artificial dentures with retaining hooks, bits of metal, wire, etc., present great potential dangers if injudiciously pulled on. Usually they require pushing to withdraw the point of the hook. A very difficult problem was presented by the very sharp, hook-shaped point of the wire, Figures 8 and 9. The sharp, hook-shaped extremities were liberated by sidewise movement and then were gotten into the mouth of the esophagoscope, where they were prevented from harming the esophagus during withdrawal. Traction on the part first presenting would have resulted in perforation into the mediastinum.

A few words on prophylaxis may not be amiss here. The presence of this sharp-pointed piece of wire in this woman's esophagus points to the carelessness of using an old broken egg beater in making the custard pie, the swallowing of a piece of which led to the

1. Jackson, Chevalier: A Fence Staple in the Lung, *THE JOURNAL A. M. A.*, June 5, 1915, p. 1907.

accident. The frequency with which we have removed small bits of bone from the air and food passages of children and adults points to almost criminal carelessness on the part of the butcher shop and kitchen. Pins and needles should not be kept in the kitchen, nor should they ever be held in the mouth while dressing or sewing or at any other time. The fifty pins, needles and similar pointed objects we have removed point to avoidable accidents. Children should be taught not to put in their mouths anything not fit to swallow. The author has collected from the public press in a single year forty-three cases in which children died from the lodgment of a foreign body in the larynx, death occurring before a physician arrived. All toys should be regularly inspected for loose small parts that might be put in the mouth. Coins, poker chips or other small objects should not be used for teething rings. Workmen should have some carrier other than their mouths for tacks, nails, screws, etc. No one should go to sleep with an artificial denture or any other loose object in his mouth. Even an undissolved tablet has been known to cause death by asphyxia. The fact that, thanks to bronchoscopy and esophagoscopy, such objects can be almost invariably removed through the mouth without operation does not excuse the ignorance or carelessness that permitted the accident to occur.

Tightly Fitting, Corklike Bodies.—These are especially apt to be associated with an annular edema of the bronchi which prevents a proper spread of the forceps' jaws. Two very successful methods of dealing with the problem have been previously published. Briefly described, one is by means of the lip of the bronchoscope making sidewise pressure to permit the insinuation of the hook below one side of the foreign body. The hook is then turned and the foreign body pulled on sufficiently to withdraw it above the annular edema where it can be seized with forceps. The other method is by strong springlike forceps' jaws, which

push back the annular edema in one plane. These two methods have been successful in dealing with this problem in fifty-two cases, without mortality.

Soft, Friable Bodies in the Bronchi.—The essential difficulty in most of these cases is to take sufficient hold with the forceps to permit the withdrawal of the body and yet not such a firm pressure as to crush the intruder. While the fragments of these bodies may be coughed up if comminuted, a much more likely result is to have fatal multiple abscesses with a septic bronchopneumonia as the result of aspirating the fragments into different portions of the lung. We have had sixty-two cases of soft friable bodies including nut kernels, maize, and various vegetable substances. The foreign substance was removed in all of the cases. There was no operative mortality, but our "follow up" system discovered that two of the patients had died a number of weeks later of septic pneumonia. In both of the cases the foreign body was a peanut kernel. No postmortems were obtained, but it seems probable that some fragments of kernel remained behind either from the breaking off of a fragment when grasped by the forceps, or the foreign body might have been multiple in the first place. It is also possible that the very violent septic bronchitis which is found in practically all peanut cases may have been more than the child could combat.

Bones.—The problems of dealing with bones are concerned chiefly with their shape, and these have already been mentioned in connection with pointed objects, transfixing objects, etc. Of bones in the larynx trachea, bronchi and esophagus we have had forty-seven cases. The bone or bones were removed in all cases. No anesthetic, general or local, was used except in two cases where the bone was of enormous size and very sharp. Here the relaxing effect of anesthesia was deemed necessary for safety, to prevent the esophagus being lacerated by spasmodic gripping of the foreign body on removal. In all of the cases of

bones, the patients, with a single exception, made a perfect recovery. The exact cause of the one death, some days later at the patient's home, was undetermined. The patient had a nephritis, though this was stated not to have been the immediate cause of death.

Disklike Objects.—These usually present no difficulty unless they are somewhat saucer-shaped and wedged in swollen mucosa and transversely placed. In this case the lip of the bronchoscope is used to make a slight crevice or dent in the swollen mucosa at one part of the disklike object so that an edge can be drawn upward to be seized by the forceps. Pins, sharp points or serrated edges, on disks, complicate the problem and require rotation so as to prevent laceration of the tissues during withdrawal of the foreign body. Sixty-four cases of buttons, coins, skirt weights and similar disklike objects, including a poker chip, have been removed in our clinic without anesthesia and without mortality.

ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. RIDPATH, LYNCH AND JACKSON

DR. WILLIAM BRICKER CHAMBERLIN, Cleveland: Just as the bronchoscope marked an advance over the older indirect method, so suspension laryngoscopy has marked an advance, but in a fairly limited field, over the bronchoscope. Dr. Lynch has made some decided contributions in the endolaryngeal instruments which he has devised. I have used a few of them, and find them exceedingly valuable. The advantages of suspension laryngoscopy must be apparent to all who have used this method. The first thing that must occur to one is the advantage of this method in having the patient suspended by a mechanical device, thus leaving both hands free for any manipulation. The very striking advantage of having two hands free came to me sometime ago, when in a rather short space of time I had three cases of open safety-pin in the esophagus. I was able in each case to dilate the opening of the esophagus with a pair of nasal forceps, and by grasping the head of the pin and giving the forceps a turn bring the eye of the pin into view. Then I grasped the eye of the pin with a second forceps, thus doing a version in the esophagus the same as we do a version in the uterus. Suspension laryngoscopy is especially valuable in children. It certainly has rendered the handling of the larynx in children a very successful operation. Much of this work could probably be done equally well by bronchoscopy but it certainly is much easier to accomplish by means of suspension. In children with suspension, a general anesthetic is necessary. In the adult one may use either a general or a local anesthetic, depending on the disposition of the patient. Suspension laryngoscopy vs. bronchoscopy: Each has its special field. One who has examined the hypopharynx or larynx with the bronchoscope can fully appreciate the added advantages which suspension affords. You have the whole field immediately in view, and you can demonstrate this field to those who have never seen it before—men who are not experienced in the use of the laryngeal mirror. I want to enter a plea that we continue to perfect ourselves in the old method of indirect examination and indirect operation. Dr. Lynch has well said that suspension laryngoscopy is not a procedure for the country home on the kitchen table or ironing board; nor is it a procedure for the office; it is a hospital operation. Many growths in the larynx can be removed just as successfully by the indirect method as by the direct, and if any one of you had the choice between having a small papilloma of the vocal cord removed by the indirect method in a few moments in a physician's office, or going to a hospital and submitting to the discomfort of suspension, you would not be long in making up your minds. There has been such enthusiasm over bronchoscopy and suspension laryngoscopy that many of the younger men

have failed to perfect themselves in the old technic of indirect examination and indirect operation. This is a great mistake.

DR. THOMAS HUBBARD, Toledo, Ohio: In the invention of instruments for bronchoscopy or esophagoscopy it is exceedingly important that they be considered from all points of view. Any instrument for grasping a foreign body that will not permit easy release is a dangerous instrument. A curved hook should not be used in the tracheal tract, because it is possible to so engage the curved hook in a ring of the trachea or bronchus that it is very difficult to let go. A right angle hook is much safer.

I want to endorse Dr. Jackson's statement that, as a rule, we should use as small a tube as possible. There are exceptions. Peanut cases are liable to develop pneumonia, and the reason is probably the multiple fragments. It is important to remove large and small fragments without a reinsertion of the tube, because of danger of subsequent laryngeal edema. With exception of cases of that character I think the small tube is preferable. We should also bear in mind the liability of overlooking a foreign body which may be impacted in the ventricles of the larynx. The same applies to foreign bodies in the esophagus and here the large caliber tube is particularly indicated.

DR. SAMUEL IGLAUER, Cincinnati: If I understood Dr. Ridpath's statement correctly, he implied that primary tuberculosis of the larynx might not be an uncommon thing. That statement would have to be questioned somewhat. We might not be able to demonstrate tuberculosis elsewhere than in the larynx, but the real test is the postmortem test, and I believe postmortems show that primary tuberculosis of the larynx is exceedingly rare. If it were primary the prognosis would be much more hopeful. As to the use of the cautery in tuberculosis of the larynx: I have had occasion recently to look up the literature on this subject, and it seems to me that our prognosis should be much brighter now than ever before, especially if one reads the article by Ruedi of *Davos*. He treated over 500 cases, using chiefly the cautery according to the method of Siebenmann, which consists in destroying the entire tuberculous lesion. He claims 33 per cent. of cures in all his cases. Some of his cases, however, have been under observation too short a time to allow for such a high percentage, but nevertheless there is no doubt but that we should take a more favorable view of tuberculosis of the larynx, especially if the patient has not much pulmonary involvement. The statistics of Siebenmann are better; they have covered a larger period of time, and his percentage is 16.

I understood Dr. Ridpath to say that he could cure papilloma of the larynx in children by fulguration. I would like him to go into details as to how he carries out the treatment and how many cases he has had. I have used it

but once, without any apparent results. He also spoke of radium. You may do damage with radium. I have one case now where I am firmly convinced that I destroyed the papilloma, but burned the larynx to such an extent that he has a condition which is very difficult to relieve. Radium was applied three times. The third application produced the burn, so that great precaution should be taken in the use of radium inside the larynx. I used 50 milligrams for about seven or eight hours.

Dr. Jackson believes in preparedness in bronchoscopy. I attempted to remove a screw from an abscess in the lung. It had been in situ for three years. I was unable to see anything by bronchoscopy owing to the excessive amount of pus. I therefore procured a giant magnet. A steel rod previously shaped was introduced through the tracheotomy and the magnet applied to the rod. The screw came out dangling on the end of the rod. Dr. Jackson also spoke of the method of seizing the point of an open safety-pin and drawing it into the tube. I have done this four times. Twice it was very easy because the pin was in the hypopharynx and I could remove it through the Jackson speculum. But in the two other cases the pin was in the esophagus and while I seized the point of the pin and was able to withdraw it successfully, yet when it came out it opened wider and dropped back into the mouth. As the pin was withdrawn the clasp of the pin caught on the cricoid cartilage. As an aid to bronchoscopy in very small bronchi I have devised a little instrument, a "bronchioloscope." The object of the instrument is to give an unobstructed view by sliding a flexible forceps along the outside of the bronchioloscope.

DR. H. P. MOSHER, Boston: Dr. Jackson has given us the last word on the mechanical extraction of foreign bodies. Dr. Ridpath works along the line I have suggested and has given us his results. Primary tuberculosis of the larynx, if it is ever to be discovered by anyone aside from the pathologists, is to be discovered by the man working with the lighted tube.

Dr. Jackson has forced a revolution in the method of anesthesia in the examination of the trachea or esophagus. Dr. Ridpath was not specific on this point. I would like to know whether he succeeds in making his diagnosis and carrying out his repeated treatments without any anesthetic.

Speaking of the movement of foreign bodies in the trachea, I was reminded of a case which puzzled me quite a bit. This was a foreign body in the esophagus. When this child was brought in with a history of having swallowed and retained in the esophagus a nickel when the fluoroscope showed that the nickel had not passed down, but was in the usual place at the opening of the esophagus, and had an upward and downward movement of one to one and a half centimeters. That immediately brought up the question whether I had

not made a mistake and that it was in the trachea. It proved, however, at operation to be in the upper part of the esophagus. The explanation of the movement was that the nickel was large enough to distend the esophagus quite a bit, and, of course, as it extended it distended the anterior wall of the esophagus, which is a common wall with the trachea, the movement of the trachea transmitted the foreign body to the esophagus.

DR. ROSS H. SKILLERN, Philadelphia: We can all do that work and we should do it. When we do this bronchoscopic work we have to forget time entirely, because the *sine qua non* of the whole thing is thorough anesthetization of the parts. That takes perhaps ten to fifteen minutes with each patient. We use a very strong solution of cocain with epinephrin, and keep on using that until the larynx and glottis are absolutely anesthetized. Then introduce the laryngeal speculum and the other instruments. Dr. Lynch in his suspension laryngoscopy has given us one of the greatest advances that we could possibly have. I think I have used nearly every model that Killian devised. They were all good more or less, some of them much more satisfactory than others—they seem to improve progressively—the last model, however, was not as good in my hands as were others. We had trouble with our long epiglottis retractor. The instrument would bend, it seemed too flimsy. I got a couple of teeth one time, pulled them out of the upper jaw. But on the whole, I was always more or less in a strain while the baby was being swung up. Now, since Dr. Lynch has perfected his instrument I go about it without any fear or trembling whatever. The great advantage of his instrument is its solidness. You can put it in there and you can absolutely hold up the epiglottis. One must admit his instrument is more difficult to introduce than the Killian, because with the Killian we do the suspension first, whereas with his instrument you have to be able to perform a direct laryngoscopy before you can introduce this instrument properly. Killian made a great stride in his discovery, but it was an American that brought the instrument to its present state of perfection.

DR. GEORGE F. COTT, Buffalo: These patients return after having the bronchoscope introduced several times, not to have the procedure repeated but because they want the effect of the cocain. I know we had a few in the Killian clinic, and they came back for the cocain.

DR. W. E. DIXON, Oklahoma City: Most of these cases can be treated without any cocain at all. I find it very satisfactory to pass the bronchoscope with the Jackson instrument and treat the larynx medicinally without any cocain—much easier with the Jackson speculum than with the Bruening or the Kohler.

DR. GEORGE F. KEIPER, Lafayette, Ind.: We need not be in a hurry to pass the bronchoscope. I remember a case where I missed a foreign body and it was because the physician insisted that I pass the bronchoscope without first obtaining a roentgenogram. As a rule, the patient declares he can locate the foreign body in the trachea or gullet, absolutely locate it, and yet when you have a roentgenogram made there is sometimes no foreign body nor any evidence that there ever was a foreign body there. In locating a foreign body in the eye the patient can always tell you where it is, but do you find it in this place? Not at all. With reference to the treatment of asthma by the use of the bronchoscope, I have had some experience along that line and I have never failed to relieve obstinate cases which were not relieved by any other means by the use of the bronchoscope, following out the plan of Nowotny of Krakau and also as reported by Frudenthal, as well as by Secord Large of Cleveland and Henry Horn of San Francisco.

DR. ROBERT H. GOOD, Chicago: I would like to ask if anyone has tried blocking the superior laryngeal nerve with novocain for this purpose. I did this the other day and it certainly worked nicely. This patient made no complaint on passing the bronchoscope.

DR. LEE COHEN, Baltimore: I would like to place on record a case of laryngeal papilloma in a child of 5 years, which was operated five times in fifteen months, suspension laryngoscope being employed. In spite of the most thorough removal, the use of alcohol, etc., the growth recurred with monotonous regularity until after the last operation, about nine months ago. Dr. Burnham, an associate of Dr. Howard A. Kelly, was requested to use radium. While the details as to dosage or the duration of each application cannot be given, it can be stated that the number of applications were four, and all of these were made from the outside over the larynx. There has been no further sign of recurrence, nor have any contractions within the larynx occurred, as has been observed repeatedly when radium applications were put inside of the larynx. Furthermore, in spite of the most extensive cutting operations, involving almost every portion of the larynx the child's voice is perfectly normal.

DR. J. W. MURPHY, Cincinnati: I had a case in which the stem of the tracheotomy tube which the patient had been wearing became loosened and was inspired into the left lung. There were no physical signs. A few hours after the accident the only pain complained of by the patient was between the shoulder blades. I have also had several cases of bone foreign bodies in the esophagus, and all the patient could say was that the pain was in the region of the scapula.

I think the internists have solved some of these problems in reference to pain in and around the stomach in which the pain is located high up near the shoulder.

DR. WILLIAM REDFIELD BUTT, Canton, Ohio: The point made by Dr. Good in reference to anesthetization of the larynx should not be lost. It is valuable. Dr. George Fetterolf of Philadelphia, a couple of years ago, read a paper on alcohol injection of the superior laryngeal nerve for relief of pain in laryngeal tuberculosis, and it works very well in those cases. The superior laryngeal nerve supplies sensation to the entire mucosa of the larynx, with the exception of the tip of the epiglottis. It can be injected with an ordinary hypodermic needle in the space between the hyoid and thyroid externally. Combining this with a little cocain applied locally within the larynx to the tip of the epiglottis gives full anesthesia of the whole larynx.

DR. ROBERT F. RIDPATH, Philadelphia: I made the statement in my paper that tuberculosis of the larynx is decidedly more common than the literature indicates. I also gave my reasons why we have not diagnosed it more frequently—partly due to our own inability, and partly due to it being masked or simulating other forms of infection of the larynx. As my paper limited my subject to the nonoperative procedures it was necessary to have as complete a paper on that subject as possible. I mentioned fulguration in papilla of the larynx. In the paper I did not state that I had used it personally. My statement is entirely a quotation. Dr. Harmon Smith of New York has used it quite successfully. Dr. Yankauer of New York City also uses it. Personally, I have never used it. The treatment which I have instituted, which is entirely of a medical nature, you will find incorporated in the paper. I, of course, could not speak of the surgical end in this paper.

In the examination of asthmatic cases you will find it is practically an impossibility to examine these, especially at the first examination, without the use of cocain. You have a person who has a cough which is irritating and frequent; you have an upheaval of the whole chest; you have also the natural nervousness of the patient due to the disease. All of these must be overcome. Personality overcomes some obstacles, but cocain overcomes decidedly more, so we use cocain. We do not use, as has been mentioned by Dr. Dixon, a saturate solution of cocain and epinephrin in these cases, but we anesthetize the pharynx and the epiglottis with a 20 per cent. cocain solution. The trachea and bronchi can be anesthetized, if necessary. These are applied with a tampon and a long applicator. In my former paper I gave my methods of applying this to the trachea. Patients do not come back for the effect of the cocain. Anyone who has had cocain applied to his throat will not come back for the second dose if he did not receive some benefit from

the other medicinal agents which have been applied. In fact the cocain absorbed from mucous membrane is anything but pleasing. They come back because we have helped them. I have shown you a tube or applicator which I devised for the application of high frequency ultra violet rays. We are not at this time able to give any definite data on the subject, but we think it is an agent which all investigators should look into.

DR. CHEVALIER JACKSON, Pittsburgh: One by one the various parts of the human body are being subjected, so far as possible, to examination by the eye. If the bronchoscope is ever to attain the full measure of usefulness which it deserves, it will be necessary to do the bronchoscopy either under local anesthesia or without any anesthesia, general or local. The internist, rightfully, will object to subjecting his patient to a general anesthetic, when the symptoms are slight; in other words, in that early stage in which a diagnostic bronchoscopy is particularly indicated. This is very different from the foreign body bronchoscopy, in which the operator is perfectly justified in using any anesthetic that appeals to him as best in the particular case according to his personal equation. In our clinic, Dr. Patterson and I use no anesthetic at all in children under about 10 years of age; in those above this age local anesthesia is used in bronchoscopy and direct laryngoscopy. We do not use general anesthesia for either bronchoscopy, esophagoscopy or laryngoscopy. Dr. R. H. Johnston tells me he gets good results from alypin anesthesia. In any case requiring repetition of the procedure the danger of drug habit, as mentioned by Dr. Cott, is very great, and I think all such work should be done without any anesthetic. There is one point in which our experience does not coincide with that of Dr. Ridpath. We have never yet found it impossible to do a direct laryngoscopy or a bronchoscopy on any patient who could open his mouth. Possibly our turn is yet to come. Dr. Hubbard's point in regard to the danger of seizing a foreign body with a snare or any other instrument which cannot be made to let go if necessary so to do, appeals to me as being exceedingly valuable. I never had that experience but once in the early days of bronchoscopy, I had a bronchoscope fastened in a bronchus by a pin being projected by cough through the holes of the bronchoscope, the point entering the opposite wall. The transfixed bronchoscope could not be withdrawn until I broke the pin with forceps, taking two fragments out separately. I have since modified the holes in the bronchoscope so that this accident cannot happen again. Dr. Hubbard's point about the peanut kernel is also excellent; but it seems to me it would apply only to peanut kernels not too large to be drawn into the distal end of the bronchoscope. Larger fragments would be crushed by the forcing shut of the forceps's jaws enter-

ing the tube mouth. I wish to emphasize Dr. Iglaue's caution in regard to the use of radium. We have not used it for anything except cancer. Overdosage, especially in case of a benign growth, might end in disaster. I think the point made by Dr. Mosher in regard to the movement of a foreign body in the esophagus, most important. Dr. Skillern's remarks about the time required for bronchoscopy deserve emphasis. Bronchoscopy hastily done in between a hard day's work on tonsils, adenoids and other routine surgery is not conducive to the best results. The experience of Dr. Dixon corresponds with that of Dr. Patterson and many others.

Dr. W. R. BUCK, Canton, Ohio: I should like to ask Dr. Jackson if he has had any experience with direct laryngoscopy after thyrotomy, and other laryngeal operations.

Dr. JACKSON: Any operation on the neck is apt to create adhesions that will make direct laryngoscopy more difficult; but we have not yet encountered a case in which it could not be done. We have many cases, especially in children, who have had papillomata or diphtheria in whom thyrotomy or laryngostomy has previously been done. In any of these cases exposure of the larynx is made easy by inserting the laryngoscope at the side of the tongue instead of over the dorsum. This does away with the necessity of so much displacement. External esophagotomy may render esophagoscopy exceedingly difficult; but with care and patience the esophagoscope, as well as the bronchoscope, can be introduced in any patient who can open his mouth.

EXTERNAL NASAL DEFORMITIES

CORRECTION BY SUBCUTANEOUS METHOD

LEE COHEN, M.D.

BALTIMORE

In 1914 my work along these lines was described,¹ and photographs of patients before and after operation were shown. In this paper credit was given to those workers whose results had been a stimulus to me, and a detailed bibliography was appended. Originality was claimed only for such modifications as seemed best in the attainment of results.

I beg, therefore, to offer the following as but a supplementary report, and have selected four cases in which are embodied some observations made since the previous publication. I would also ask your indulgence should a too detailed description of the work be given. The desire is to spare those beginning this work the great difficulties encountered by me, failing to find the minute but very important details in the literature at my disposal.

Although in my report at that time, of twenty-two cases no infection had taken place, soon thereafter I received quite a jolt when two cases of infection followed operation in quick succession. In one instance I felt certain that the cause might be ascribed to the tincture of iodine, which was used for the first time instead of the routine cleansing of the vestibule employed in former operations, and I would, therefore, discourage the use of iodine for this purpose. Relief in this instance was obtained by drainage from within the interior of the nose, and the result was not materially affected.

1. Cohen, Lee: *Corrective Rhinoplasty*, *Laryngoscope*, June, 1914.



Fig. 1 (Case 1).—Before operation.





Fig. 2 (Case 1).—After operation.



Fig. 3 (Case 2).—Before operation.



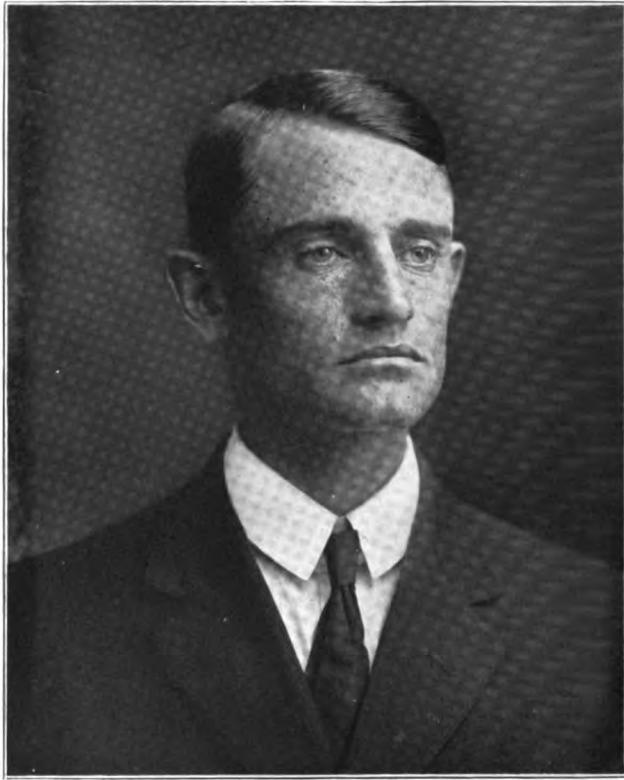


Fig. 4 (Case 2).—After operation.



Fig. 5 (Case 3).—Face view before operation.





Fig. 6 (Case 3).—Face view after operation.



Fig. 7 (Case 3).—Three-quarters profile before operation.





Fig. 8 (Case 3).—Three-quarters profile after operation.



Fig. 9 (Case 4).—Before operation.





Fig. 10 (Case 4).—Roentgenogram taken ten days after transplantation of bone in septum.



Fig. 11 (Case 4).—Roentgenogram taken sixteen months after transplantation of bone in septum.



Fig. 12 (Case 4).—After operation.



If we would obviate infection of the wound, too great a stress cannot be laid on proper technic in preparing the field of operation. The vestibule of the nose should first be prepared by careful removal of all hairs, using a small barber scissors for the purpose. The nose should then be thoroughly douched with sterile normal salt solution, after which soap, water, ether and alcohol are used to complete the process in the vestibule. The entire face is also cleansed in the same surgical manner, and is afterward so draped with sterile towels that only the nose and mouth remain exposed. Several layers of handkerchief gauze are now used to cover the mouth, the patient being thus enabled to breathe freely. In each instance the entire nose, with the exception of the vestibule, is packed with sterile gauze, and over this a pledget of cotton saturated with alcohol is placed. In case a general anesthetic is employed, a posterior nasal tampon is made use of to prevent the blood from reaching the pharynx and larynx.

To diminish further the likelihood of infection, I have made it a rule in undermining the skin, and in all subsequent steps of the operation, to reintroduce as seldom as possible the same instrument after its withdrawal from the wound. I deem it imperative, of course, that rubber gloves be used by the operator and his assistants.

In the second case of infection, transplantation of bone was attempted, and the error of placing two pieces of thin bone, one on the other, was made, instead of utilizing a single and thicker piece of bone so that the transplant would receive nourishment from both upper and lower surfaces, as was later done in a case to be described in this paper. In this infected case it was necessary to remove the transplanted bone; consequently the desired results were not obtained, and another attempt will shortly be made to effect a successful correction.

CASE 1.—Woman, aged 37. Somewhat oversized nose, with convex vertical deformity involving the bony and cartilaginous dorsum from the frontal notch to the tip. The tip drooped and the columna nasi extended about one-fourth inch below the planes of the edges of the alae. The deformity had caused the patient much unhappiness since early womanhood.

Oct. 15, 1915, under local anesthesia, the skin over the entire nose was undermined through the usual incisions, one on each side, made from the interior of the vestibule, parallel with and just below the edges of the nasal bones and nasal processes of the superior maxillae.

This being accomplished, the entire bony dorsum was sawed through (about one-fourth inch below the summit of its most convex portion), from the frontal notch down to the beginning of the cartilaginous portion. Before sawing through the bone, however, the periosteum was cut through along the same line with the sharp edge of a small periosteal elevator, to avoid the ragged edges which would necessarily have been made with the saw. The saw was introduced first into the left side, the left nasal bone was severed, and the septum, close to the summit of the nose, sawed through. A fresh saw was then introduced into the right side and the same thing accomplished. But slight lateral pressure was then needed completely to mobilize the bone thus separated. Pressure on the lower end of this segment removed every appearance of a hump nose. Where the convexity of the bony dorsum is a gradual one, without irregularities, it is not always necessary to remove any portion of the bone to secure a straight profile, for in such case the hump is the result of an exaggerated prominence of the lower ends of the nasal bones.

There still remained the elongated tip and the rather low plane of the columna to be corrected. This was accomplished by the removal of a triangular piece of the lower portion of the septum, the apex of the triangle being situated at the anterior nasal spine, the base (about 7 mm. in width) being situated upward and forward beneath the cartilaginous dorsum of the nose, just above the fleshy tip. This was done by first transfixing the membranous septum with a small knife, and cutting upward and forward to the dorsum nasi; the incision thus made formed the lower arm of the triangle. A similar diverging incision was made above, through the lower part of the quadrilateral cartilage, forming the upper arm of the triangle.

The piece removed consisted, therefore, partly of the membranous and partly of the cartilaginous septum. This step is well illustrated by the diagram of Joseph. The edges of the wound thus made were brought together by four superficial sutures of black silk on each side of the septum, after which two deep mattress sutures were introduced through

the cartilaginous septum above and the columna nasi below, so that should the superficial ones pull out a sagging of the tip would be prevented. These deep sutures also obviate any sagging that might result from the stretching of the skin and mucous membrane.

The vestibule was packed with iodoform gauze, and a copper splint, made for this case, applied in the manner described in my former monograph. It might be added that I am now lining all splints with surgeon's lint, which greatly diminishes pressure on the skin and adds much to the comfort of the patient.

The first dressing was allowed to remain four days, after which it was renewed every forty-eight hours. All sutures were removed on the eighth day. The patient remained in the hospital one week, after which time she came to the office to be dressed for a period of five weeks. She returned home six weeks after the operation, with the result shown in Figure 2.

CASE 2.—Man, aged 26. While at first glance this deformity bears some resemblance to the one just described, on closer observation the following differences may be noted: The hump is higher up and sharper cut, there being a distinct space between it and the lower ends of the nasal bones. The surface of this convexity is not regular, there being a sharp ridge on each side of the hump, the result of fracture due to a blow received at the age of 14.

The method of correction in this case, with the exception of the undermining of the skin, was quite different from that employed in Case 1. The entire hump was sawed through, slightly below a line drawn from the frontal notch above to the plane of the cartilaginous nose below, in order to include the ridge on each side. The segment thus mobilized was taken out through the wound, care being exercised that it did not touch in any way the skin of the interior of the vestibule, thus avoiding possible infection from this source. To accomplish this a modified Killian speculum, such as he used in rhinoscopia media, was introduced into the wound and opened somewhat as it was pushed forward, so that the separated segment, held by the finger over the dorsum nasi, was forced between the blades of the speculum. When thus engaged the speculum was withdrawn containing the piece of bone, which was immediately immersed in warm saline solution. The nasal dorsum now presented a somewhat dished out appearance. With a pair of Freer bone forceps, most of the bone making up the removed segment was cut away, leaving a strip of tissue consisting of the periosteum and soft parts. This strip was again laid between the blades of the speculum, reintroduced into the wound, and, when placed on the dorsum, completely filled the depression caused by its removal. The dorsum then presented an even, symmetrical appearance.

No stitches whatever were used in this case, the vestibule being simply packed with iodoform tape and the copper splint applied. The result, after primary healing, shown in the picture taken five weeks later (Fig. 4), illustrates the extent to which we may venture in these operations if only the strictest asepsis is observed.

CASE 3.—Man, aged 40, presented a grossly oversized nose, the hump involving not only the bony but also the cartilaginous portion down to the very tip. The anterior edge of the triangular cartilage could be distinctly felt through the skin, above the level of the lateral walls of the nose. The columna at its posterior end extended downward to within three-sixteenths inch of the vermilion border of the lip, and the tip drooped considerably. The shortness of the upper lip, along with this nasal deformity, gave to the patient an unusually displeasing appearance.

After undermining in the usual way, the bony portion was sawed through at a much lower level than in either of the foregoing cases. The saw edge, instead of being placed at right angles to the bone, was turned somewhat upward, giving to the edges of the wound a beveled effect. Thus, after complete mobilization, the edges of the displaced fragment were made to overlap the lower edges of the sawed wound, lowering considerably the plane of the dorsum. This accomplished, a sharp knife introduced through the original incision was used to prune down the convexity of the cartilaginous septum, a small strip of which was taken away. There still remained the tip and the columna to be dealt with. These defects were remedied by the removal of a wedge shaped piece of the septum about one-third inch wide at its base, in much the same manner employed in Case 1.

In addition to this, for the purpose of shortening the lateral walls of the cartilaginous nose, a small wedge shaped piece was removed from the interior of each side wall, the apex of the wedge being located just above the bulge of each ala, while the bases (about 7 mm. in width) met over the septum. By approximating the edges of the three wounds so made with black silk sutures, a shortening of the entire nose was accomplished, making the upper lip considerably longer and changing the entire facial expression.

CASE 4.—Man, aged 20, came to me in the dispensary of the Hebrew hospital, with the pathetic story that owing to his deformity he could not obtain a position. His father, being under the impression that the boy did not desire work, made things rather uncomfortable for him. It will be seen from Figure 9 that this nose bore some resemblance to the back of a Bactrian camel, and gave to the face a hideous, almost criminal expression.

In 1904 the patient was struck on the nose with a piece of lumber which fractured both nasal bones, the upper large hump resulting. In November, 1914, he received a blow on

the nose with a whip handle, causing a septal abscess for which he sought treatment only after the entire cartilaginous septum was destroyed. The contracture following this abscess caused the depression seen on the lower part of the nose. The skin over the bony hump was red, very sensitive, and, in the absence of the cartilaginous septum, afforded the only support for the tip of the nose. Evidently more than one operation would be necessary in this case, and it was found best to divide the operative work into three stages.

Jan. 5, 1915, an attempt was made to furnish some substantial support for the tip of the nose. Under local anesthesia, after separating the two layers of the septal mucous membrane (as is done in the usual submucous resection), two thirds of the right lower turbinate bone was removed with the Struychen scissors. The bone was completely stripped of the mucoperiosteum, straightened out and cut to the desired shape. This piece of bone was then planted between the layers of the septal mucous membrane, one end being placed against the anterior nasal spine, the other beneath the nasal dorsum, just above the fleshy tip. The septal incision was then sewed, and a Roe spring clamp introduced into the anterior nares to relieve undue pressure on the transplanted bone until it had well taken hold. The nose was packed with iodoform tape in the usual way. Healing took place by first intention.

A roentgenogram taken ten days later (Fig. 10) showed the transplanted turbinate bone to be in splendid position, and supplying in every way the support for which it had been intended. Another roentgenogram taken sixteen months later (Fig. 11) shows the bone still in position, though somewhat smaller in size than when introduced.

In addition to this, the latter picture shows a substantial line of ossification extending upward from the original transplant below to the bony septum behind the nasal bones. As previously stated, the mucoperiosteum was entirely removed from the bone before it was placed between the two layers of the septal mucous membrane. It must be inferred, therefore, that nourishment for the transplanted bone was furnished by the mucoperichondrium of the septum, and that it is not always essential that bone so transplanted should be covered by the periosteum to insure its life and further ossification.

Three weeks later a second operation was performed on this nose. Under local anesthesia, after undermining the skin, the large bony hump was sawed off and moved downward to fill in the depression over the cartilaginous portion. In applying the copper splint here care was exercised lest the pressure be so great as to interfere with the nourishment of the bone in its new position. Healing was uneventful, but there still remained a slight indentation over the cartilaginous portion of the nose.

So satisfied was the patient with the result thus far obtained that seven months now elapsed before his consent could be gained for the third and final step in the correction of the deformity. Sept. 30, 1915, under ether anesthesia, after again undermining the skin and preparing the dorsum nasi for its reception, a longitudinal section was removed from the fourth right sternocostal cartilage and placed on the nasal dorsum, to fill in the depressed portion. This section, with perichondrium attached to its outer surface, was about $1\frac{1}{4}$ inches in length and included only the outer half of the entire thickness of the costal cartilage, the inner half being left in situ, so that the thorax wall need not be too greatly weakened.

The strip of cartilage so removed curved markedly toward its perichondrial surface, and this curve made it necessary to place it transversely, with its perichondrium downward against the cartilaginous framework of the nose. Owing to the curvature, however, it conformed nicely with the convexity of the dorsum.

The vestibule was packed as before with iodoform gauze, and the copper splint applied in the usual way. Healing took place without a mishap, with the excellent result shown in the photograph taken six months afterward (Fig. 12).

The psychologic effect on the patient, after the change wrought in his appearance by this work, is most interesting. While before this, as shown in the first picture, he gave no heed whatever to his attire, afterward he dressed with the greatest care before having his photograph taken.

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ABSTRACT OF DISCUSSION

DR. WM. WESLEY CARTER, New York: There are points in Dr. Cohen's paper with which I do not altogether agree. With reference to the use of tincture of iodine as an antiseptic I feel that this drug has assisted me greatly in this work. It is very important in rhinoplastic surgery to have strict asepsis. My method of preparing the patient is to cleanse the entire face and nose with green soap and water. This is followed by alcohol, and this by tincture of iodine. In preparing the nose itself, the vibrissae are removed and the nasal cavities are cleansed with Dobell's solution. I then pack the nose beyond the point where I expect to make my incision with nonabsorbent cotton. I then paint the inside of the nose with tincture of iodine. The incision is made in all my work from within the nasal cavity in the interval between the upper and lower lateral cartilages. This point is very clearly recognized by one who is accustomed to do this work and is shown by a slight fold of mucous membrane. I use a small knife especially made for this purpose.

I believe in completing the elevation of the tissues as nearly as possible through the one incision, by means of the instrument that is introduced at the beginning of the operation. In nearly every instance I make my incision on only one side, that is, through the left nasal cavity. The elevation of the tissues is carried on deeply, as near the bone as possible, under the periosteum over the nasal bones, if possible. Dr. Cohen said that he made a mistake in transplanting two strips of bone instead of one large piece. He transplanted the bone right, but he got infection, that is what caused the trouble. Osteogenesis is relatively far greater in the small fragments of bone than in the large fragments. That portion of bone that is farthest removed from the blood supply has a tendency to absorb, even if these small, thin strips of bone are used, and for that reason I think it far better to use a number of small strips which are more easily nourished rather than a large strip which will begin at once to be absorbed from the center. In these shortening operations I do not, as a rule, use the copper splints for retaining the nose in position, after taking out a wedge of bone and cartilage. The apex of my wedge is at the nasal spine, which is removed, the base of the wedge reaching out to the dorsum of the nose. The mucous membrane is elevated for a short distance from the cartilaginous septum that remains in order that we may close the perforation with sutures after the tip is raised. A strip of adhesive plaster is run from the inner canthus of one eye around the tip to a corresponding position on the other side of the nose. This holds the tip in its elevated position and relieves all tension. The nasal cavity is then packed with vaseline gauze, which is prepared by placing in a test tube a narrow strip of gauze, about three fourths of the tube being filled with gauze and the remainder with vaseline, a piece of cotton inserted and the tube placed in a sterilizer for a half hour. The vaseline percolates through the gauze and you have an excellent intranasal dressing. I first advised this dressing ten years ago and used it in my submucous operations before I did this work. The copper splints I use are tinned on one surface and are padded with a thin layer of cotton. In removing humps from the nose I have used the method described—removing the hump and transplanting it to some other portion of the nose, but as a rule I remove humps by means of a special rasp, the teeth of which converge toward the center. This detritus is removed by means of a small spoon or curet. Many of my cases are of several years' standing and they show that the transplants are alive and that the deformities are permanently corrected.

DR. E. L. KENYON, Chicago: A man of thirty, an aviator, fell about 150 feet. He was strapped to the machine, and fortunately it fell under him, but he fell forward, with the

result that he was struck very hard; the cheek bones on the left side were injured, and the nasal cartilages were crushed in, producing marked depressive deformity of the front of the nose; and the nasal septum was broken, perforated, and crushed to one side. There is no question that he is going to be operated on by somebody, and I shall try to see that he gets into good hands.

DR. LEF COHEN, Baltimore: I felt certain that infection in my case, was not due to any slip in technic, but rather because neither of the bone strips received nourishment from both sides. This belief was strengthened, when on removing the transplanted bone, after infection had occurred, the upper strip had become firmly adherent to the skin from which it had received sufficient blood, and looked quite healthy; whereas the lower strip, which depended entirely on the less vascular cartilaginous framework of the nose for its nutrition, was bathed in pus, and free from attachment of any sort. The class of cases presented by Dr. Carter are quite different from those shown by me, and in them the attainment of ideal cosmetic results is not so easy. Up to the appearance of Dr. Carter's last monograph on this subject, he had been introducing the strip of bone through an external incision made between the eyebrows. I am glad to note in his discussion, that he now makes his incision within the nose, thus avoiding the scars which followed in his former operations.

CLINICAL TYPES OF LABYRINTHITIS

WITH COMMENTS ON TREATMENT

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Preliminary to a discussion of the clinical types of labyrinthine disease, may I remind you that the hardness of the labyrinthine capsule and its anatomic structure seem to be so arranged by nature that they form an unusually strong barrier against invasion by a purulent process.

It is estimated by Bezold that the labyrinth becomes involved only once in 500 cases of purulent otitis media. Friedich and Hinsberg, on the other hand, estimate its occurrence once in 100 cases. The latter seems to me more nearly correct. The most vulnerable points in the labyrinthine wall are the horizontal semi-circular canal, the fenestra ovalis, the fenestra rotunda, the promontory and, from the cranial side, the internal auditory meatus. The labyrinth may be invaded by a purulent process from three sources: (*a*) from the middle ear, (*b*) from the blood currents, (*c*) from the meninges. Our cases come chiefly from the first-mentioned type, wherein the middle ear spaces become the seat of purulent lesion, which in turn advances into the bony structure, and during its progress attacks the labyrinthine wall and finally invades the delicate structures within the labyrinthine capsule. This gives rise to our so-called purulent labyrinthitis.

The following description of the various types of labyrinthine inflammation is based largely on clinical data. Thus, we broadly divide internal ear inflammation into circumscribed labyrinthitis and diffuse labyrinthitis. Before entering into a discussion of the

subdivisions it may be well to eliminate those cases of chronic suppurative otitis media which have vertiginous attacks, but without disturbance in the functions of the labyrinth. These patients complain of attacks of vertigo, but they have hearing, a normal rotation test, a normal caloric test and no evidence of fistula. As a basis of these attacks of vertigo it is believed that middle ear disease has attacked the bony labyrinthine capsule without eroding the same. This type of labyrinthine disturbance is known as paralabyrinthitis. Probably there should be added to this type of paralabyrinthitis those cases in which the patient suffers for a few days from labyrinthine irritability as a result of irritation caused by injury to the stapes in performing a paracentesis. Such a case was recently reported by Guntzer: The family physician did a paracentesis on a patient who evidently had no infective process, but was suffering from an attack of acute catarrhal otitis media:

There was history of pain in the right ear for two days; no discharge; since the previous evening has been unable to walk; was dizzy and vomited. Examination of the right ear showed the membrana tympani slightly reddened, no bulging, and a pinhead perforation about the center of the superior-posterior quadrant, with a droplet of serous red discharge exuding. The patient had a spontaneous horizontal nystagmus to the left and rotary on looking up; on attempting to rise fell toward the right. Hearing was not impaired, no mastoid tenderness, no fever, pulse 88. Diagnosis of labyrinthine irritation was made, but no assignable cause could be elicited. This condition lasted ten days before the patient was able to leave the bed. At a subsequent office visit the patient confided that his family physician was called the evening before Dr. Guntzer's visit to the patient. The patient was told he had an abscess in his ear and the doctor used an instrument to open it, when the patient at once became dizzy, nauseated, vomited and was unable to walk. The labyrinthine irritation was most likely due to disturbance of the foot plate of the stapes. Fortunately the middle ear and labyrinth were not infected, there was no discharge and the patient escaped the dire consequences that may have followed such an infection.

The writer has had similar experiences in patients whose ear drums have been opened by inexperienced operators, but more often these accidents result in at

least an attack of serous labyrinthitis with partial or total loss of hearing, and occasionally the traumatism is followed by acute purulent labyrinthitis with fatal results. The attacks of vertigo, in such cases, are probably due to circulatory changes within the labyrinth or to transient labyrinthine irritation. Their cause, however, is not definitely known.

In a certain proportion of cases of paralabyrinthitis, as the disease progresses, one of two things occur, either there is a sudden rupture of the infective material into the labyrinth, causing diffuse labyrinthitis, or gradual erosion of the labyrinthine capsule occurs at some place, with the walling off of the infective process, resulting in a circumscribed labyrinthitis. When the latter occurs there are attacks of vertigo with nausea or vomiting, which become more severe until the patient finally seeks relief. Several of these patients have come to my clinics having practically made their own diagnosis. Thus they have stated that having had chronic discharging ears they recently found, on introducing the index finger into the external auditory canal that they were seized with vertigo, nausea and vomiting. In some instances we have been able to repeat this experiment and by firm pressure on the tragus, closing the external auditory canal, we have been able to elicit a positive fistula test. This circumscribed labyrinthitis occurs almost invariably with chronic sup-puration of the ear, either tuberculous or cholesteatomatous. In such cases the disease has not invaded the endolabyrinthine spaces. Thus, in such instances, although the bony capsule of the labyrinth has been eroded, the disease has not really entered the membranous labyrinth and the end-organs within the labyrinth still perform their functions or at least are capable of irritation.

Such patients may have a fairly acute hearing, the rotation test and the caloric test are normal and the fistula test is positive. There may or may not be spontaneous nystagmus to both sides. The writer has

records of five (formerly published) cases of this type and has seen many others. These cases of circumscribed labyrinthitis should be differentiated from the larger class of cases of necrosis of a part or the whole of the bony capsule, with destruction of the end-organs, many of which are discovered only at the time of performing the radical mastoid operation. The latter class will be referred to later in this paper.

Diffuse labyrinthitis may be secondary to either an acute or chronic suppuration of the middle ear. It may be metastatic or may result from an extension of meningitis through the pathways that connect the labyrinth with the subdural lymph spaces. The metastatic cases usually complicate mumps. Such a case was reported by the writer in the *New York Medical Journal* of Aug. 2, 1913, in a boy of 18 who was suffering from mumps of great severity, during which time he had extreme vertigo and tinnitus in the right ear followed in three days by total deafness. He was unconscious for four days. The vertigo continued for over two weeks, when it gradually subsided. After three months there was a partial return of the function of the static labyrinth, but he is still totally deaf. Endocranial complications, with the exception rarely of serous meningitis, never occur in these cases.

Diffuse labyrinthitis must be considered under two heads: first, those cases that present symptoms, so-called manifest or acute; and second, cases without symptoms, so-called latent or chronic cases. Cases of diffuse manifest labyrinthitis may occur with either acute or chronic middle ear suppuration. The onset is sudden, there is rapidly developing deafness, nausea, vomiting, vertigo and nystagmus. The vomiting differs from that of intracranial disease in that it is invariably associated with nausea. There is no projectile vomiting. The nausea bears no relationship to food. The nausea and the vomiting follow movements of the head. The nystagmus is of a mixed, horizontal and rotatory type and is directed to the sound side. With the nystag-

mus there are also the subjective sense of being turned and the apparent turning or spinning of objects in the environment. The objective vertigo consists of reaction movements of the trunk and extremities in the direction of the slow component of the nystagmus, that is, towards the diseased ear. Such patients, in attempting to walk fall toward the diseased side or stagger toward the diseased side and must be supported. There are no general symptoms, that is, there is neither rise of temperature nor acceleration of the pulse rate unless intracranial symptoms intervene. We have seen all types of labyrinthitis and are convinced that even grave intralabyrinthine suppuration may occur without fever. The following brief history will serve to illustrate:

The patient had had suppuration in the right ear for five months, with no complicating symptoms up to three days before coming under observation. Two days previously he had been seized with an attack of vomiting and dizziness, the latter of which had remained continuously. He had no rise of temperature and did not complain of pain in the mastoid, nor was there any tenderness on pressure. He was totally deaf in the right ear. He had spontaneous rotary nystagmus to the left. When walking he was inclined to fall toward the right. He was immediately admitted to the hospital, and the radical mastoid operation was performed. The mastoid antrum and cells contained a small amount of pus, and there was much granulation tissue in the tympanic cavity. There was no fistula of the labyrinthine capsule, but the region of the round and oval windows was granular and soft to the probe. The patient made a good recovery from the ether and passed a good night; was rational and answered questions early the following morning. Later in the morning he began to show signs of meningeal irritation, with a moderate rise of temperature. At noon of the same day there was a sudden rise of temperature to 105 F., he became unconscious, and died at 2:30 p. m., apparently of respiratory failure.

It must not be forgotten, in this connection, that diffuse labyrinthitis is a complication which often occurs during an acute exacerbation of chronic suppuration of the middle ear and mastoid, and fever, when it accompanies such a labyrinthitis, is, in all probability, due to the recrudescence of the mastoid disease.

The attempt by the Vienna school to differentiate between serous labyrinthitis, so called, and suppurative labyrinthitis, so called, leaves much to be desired. This differentiation rests on the retention or destruction of the labyrinthine functions. However, several cases which were clearly serous, in that they occurred during the first twenty-four or forty-eight hours following the beginning of the acute middle ear abscess, have had total destruction of functions during the height of the symptoms. A recent case occurring on my service at the Manhattan Eye, Ear and Throat Hospital, treated by Dr. Friesner, is of this type.

L. H., a man, aged 42 years, was admitted Feb. 25, 1916, complaining of acute suppurative otitis media on the right side. He refused myringotomy. Forty-eight hours after the spontaneous rupture of the drum he had an acute diffuse labyrinthitis with vertigo, nausea, vomiting, etc. Twelve hours after the beginning of the labyrinthitis he was totally deaf, had a spontaneous nystagmus to both sides, more marked to the diseased side, with no falling nor vomiting. Eleven days after the beginning of the acute otitis a simple mastoid operation was done. The mastoid healed and the middle ear became dry. He complains of tinnitus in the affected ear and is totally deaf. The caloric reaction is negative. Rotation to right, nystagmus 18 degrees; rotation to left 20 degrees. A diagnosis of serous labyrinthitis was made, based on the fact that the labyrinthine invasion occurred during the first few days of an acute otitis media and the symptoms were not severe. Hence, despite the necessity to operate on the mastoid the labyrinth was untouched.

While this differentiation is unfortunate in the selection of the terms "serous" and "suppurative," it contains this truth, namely, so long as any irritability remains in the labyrinth, extension from the labyrinth to the intracranial structures does not occur. It would perhaps have been better, then, to call those cases in which the function of the labyrinth is destroyed "grave labyrinthitis" and those in which, despite the presence of labyrinthine symptoms, the function, or rather irritability, of the labyrinth was retained "mild labyrinthitis."

The diffuse manifest labyrinthitis which complicates acute middle ear suppuration may be divided into two classes, first, those which occur within the first three or four days of the disease, and second, those which occur six, eight or ten weeks after the beginning of the middle ear suppuration, in the presence of an acute mastoiditis. In the first class the labyrinthitis is almost invariably mild or so-called serous. It rarely leads to any intracranial complication and frequently, after the middle ear suppuration has run its course, the function of the labyrinth, at least of the static labyrinth, is restored. On the contrary, the cases of labyrinthitis which complicate latent mastoiditis, and occur eight or ten weeks after the beginning of the acute suppurative otitis media, are almost invariably grave, or so-called suppurative, and frequently lead to intracranial complications, that is, meningitis. As a rule, the latter cases are due to infection by one or other forms of capsulated coccus.

As has been stated above, the labyrinthine inflammations which complicate the chronic suppurating middle ear may be either manifest or latent. As in the cases which occur with the acute otitides, the manifest labyrinthitis may be either grave, that is, suppurative, or mild, that is, serous. The suppurative labyrinthitis which is progressing to the endocranial structures, that is, arousing a meningitis, is usually accompanied by fever and headache. The writer has several records of cases of this type. The so-called labyrinthine symptoms are very violent and do not become progressively less severe. On the contrary, those labyrinthine inflammations which are mild and have no tendency to involve the meninges have associated with them, as a rule, neither headache nor rise in temperature. Furthermore, in the uncomplicated cases the labyrinthine symptoms become day by day appreciably less severe. The most important signs of an extension of the labyrinthine suppuration to the meninges are headache and fever. In these cases, of course, there will be total

destruction of labyrinthine irritability. The cerebrospinal fluid may also give us information regarding the extension of the disease to the meninges, even in the early stages.

There are cases of diffuse manifest labyrinthitis of the mild type which occur after the radical mastoid operation. This condition may come on any time during the healing of the radical mastoid cavity. It differs from the diffuse labyrinthitis which results from the disturbance of the stapes during the radical operation, in that in the former the symptoms do not occur for the first twelve hours after the operation, whereas, in the latter the symptoms supervene at once on the patients coming out of the anesthesia. By far the largest class of cases that we have met are those in which the labyrinth has been totally destroyed and in which there is no history of recent attacks of vertigo, vomiting, etc. These cases are discovered solely by making the functional test of the labyrinth, a test which we invariably make before performing a radical mastoid operation. Occasionally, no history of previous attacks of vertigo can be elicited. In others there is an indefinite history of vertigo and vomiting which has been referred to other organs, bilious attacks, for instance. The relationship between the vomiting and vertigo and the ear is not understood by them. There may be a spontaneous nystagmus directed to both sides which can be observed only when the eyes are turned to the extreme angle.

If the labyrinth destruction has existed for six months or more, it has been common in our experience to find a compensation test of rotation described by Ruttin. The caloric test is negative, as is the fistula test, and there is total deafness. When the labyrinth becomes filled with pus and granulations, there is an extension of the granulation tissue into the internal auditory canal and an occlusion of the labyrinthine artery occurs. This artery is a terminal artery and its destruction entails an extensive death of the bony laby-

rinthine capsule, with the formation of a sequestrum. In this type of cases we have frequently found a facial paralysis associated with the dead labyrinth. The facial paralysis is not invariably due to neuritis. We have seen cases in which a paralysis cleared up rapidly following the operation. Here, in all probability the paralysis was due to pressure either of the granulation tissue or of a sequestrum on the nerve. This type of labyrinthitis is as dangerous as it is insidious, and often leads not only to meningitis, but also to cerebellar abscess and sinus thrombosis. Dr. John B. Rae in a paper read before the Medical Society of the State of New York, May, 1916, suggested the following classification of purulent labyrinthitis: acute diffuse labyrinthitis, chronic diffuse labyrinthitis, paralabyrinthitis with fistula, and paralabyrinthitis without demonstrative fistula.

The treatment of labyrinthitis varies considerably and the indications for operative interference are by no means uniformly recognized. There exists, furthermore, great difference of opinion as to when one should interfere in labyrinthine disease and as to the extent of that interference. The indications for operation depend on the type of labyrinthine involvement. In patients, for instance, with chronic suppurative otitis media, who have vertigo, but in whom there are no other signs of labyrinthine involvement, either of the auditory labyrinth or static labyrinth, the radical mastoid operation should be done, without disturbing the labyrinth. This is followed, as a rule, by a cessation of the vertiginous attacks. In the type known as circumscribed labyrinthitis, where there are labyrinthine symptoms with a normal rotation test, a positive caloric test and a positive fistula test, the radical mastoid operation, only, should be done. Relief of the symptoms, as a rule, follows this procedure.

The indication for operation in cases of diffuse labyrinthitis may be considered under two heads: first, those cases of acute diffuse labyrinthitis which com-

plicate the acute otitides, and second, those cases of diffuse labyrinthitis which occur with the chronic middle ear suppuration. There are cases of labyrinthine invasion which supervene within a day or two after the beginning of an acute otitis media. In such instances it is rarely necessary to do more than a free myringotomy. These cases are, as a rule, mild and not prone to cause intracranial complications. Even where the middle ear infection is complicated by an acute mastoiditis which requires interference, the labyrinth should not be touched. And this is true even though the hearing be lost and the caloric test be negative. In many of these cases the function of the labyrinth, at least of the static labyrinth, is restored. There is but one exception to this rule, and that is cases in which the labyrinth has been injured by the myringotomy knife.

With regard to those cases, however, in which a diffuse labyrinthitis supervenes on an acute middle ear suppuration, and latent mastoiditis of six, eight or ten weeks' duration, the story is a different one. Here, the labyrinth operation is fully justifiable in connection with the mastoid operation. Failure to open and drain the labyrinth may result in a meningitis, which otherwise might be avoided. In the event of a diffuse labyrinthitis complicating either an acute or chronic suppurating ear, in which there is headache, fever, or any symptoms from which one might suspect an intracranial extension of the labyrinthine suppuration, the labyrinth, of course, should be opened and drained. It is not to be expected that recovery will take place in the large proportion of cases, but the fact that the meningeal infection may occasionally be localized offers sufficient encouragement to warrant this attempt to save life. In these desperate cases no half-way measures are permissible and the Neumann operation, in which the bone is entirely removed, including the border of the internal auditory canal, together with drainage of the cerebellar spaces, is the ideal procedure.

Perhaps the greatest difference of opinion exists regarding those cases of diffuse labyrinthitis which complicate chronic suppurating middle ears. This is particularly true to the manifest variety, that is, cases in which there are labyrinthine symptoms and in which the functional test shows complete deafness and loss of irritability of the static labyrinth. According to the Vienna school here are the indications for labyrinthectomy. If the labyrinth has been invaded by the suppurative process and has been destroyed, the functional tests will, of course, show total absence of hearing and total loss of static irritability. Many of these cases are discovered accidentally in making the functional test before doing the radical mastoid operation. It is this class of cases which undoubtedly, in time gone by, led to a meningitis of unknown origin after the radical mastoid operation. A trauma, incident to the radical mastoid operation, frequently causes the lighting up of the labyrinthine suppuration which has previously been walled off from the meninges. Therefore, in these cases it is wiser, in addition to the radical mastoid operation, to open and drain the labyrinth. In many instances this type of case is associated with facial paralysis and part of the labyrinthine wall has been sequestered. Wherever there are signs of an intracranial complication, combined with a destroyed labyrinth, the posterior fossa should be uncovered, irrespective of the type of labyrinth operation performed.

DIFFERENTIAL DIAGNOSIS BETWEEN PURULENT LABYRINTHITIS AND CEREBELLAR LESIONS

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NEW YORK

I should like to state at the outset that I have not attempted a complete résumé of the differential diagnosis between labyrinthine and cerebellar lesions. That has been done very often and very well. I have rather sketched the differentiation from the point of view of cerebellar symptomatology, paying particular attention to one or two phases of the question.

Even though the occurrence of disturbance of balance, vomiting and nystagmus are strongly suggestive of the most common cause of such symptoms, namely, labyrinthitis, it must not be forgotten that other conditions, too, may arouse almost identical phenomena. Among the conditions which may cause symptoms similar to those of labyrinthine disease the most important are lesions in the cerebellum and it is necessary, therefore, that the latter be differentiated from labyrinthine disturbances.

It is, perhaps, best to discuss this differentiation from the point of view of cerebellar symptomatology under several heads: first, general symptoms of cerebellar lesions, which may be due either to increased intracranial pressure or, in the case of abscess, to the inflammatory process in the cerebellum and, second, focal symptoms of cerebellar lesions, which may be either symptoms of disturbance in movement or symptoms of disturbance in the vestibular apparatus.

In uncomplicated labyrinthitis there is very rarely headache. In cerebellar lesions there is almost invariably headache. With abscess of the cerebellum the

headache may not be constant or it may be dull and boring, with unbearably severe exacerbations, but it is present in at least 90 per cent. of cases. With cerebellar lesions there may be disturbance of the sensorium, disturbance of respiration, bradycardia, optic nerve changes, paralysis of the cranial nerves, none of which, with the exception of disturbances in the eighth nerve, and occasionally the seventh, ever occur with labyrinthitis. There is vomiting with cerebellar lesions, as well as with labyrinthine, but in the latter the vomiting is never of the projectile type, that is, it is always associated with nausea. Furthermore, the vomiting with labyrinthitis becomes daily less, so that after a few days it ceases. On the other hand, the vomiting with cerebellar abscess is frequently projectile in type and is particularly persistent, much more so, as a rule, than with abscess in the temporosphenoidal lobe.

With cerebellar abscess and with labyrinthitis the temperature may be normal; with abscess it may be subnormal or there may be fever, but uncomplicated purulent labyrinthitis of itself never causes a considerable rise in temperature. With abscess there is frequently marked emaciation and there may be pathologic changes in the cerebrospinal fluid. In uncomplicated labyrinthitis these, of course, do not occur.

The focal symptoms of cerebellar lesions which help to differentiate them from labyrinthitis may be divided into symptoms of disturbances of movement, and symptoms of disturbances of the vestibular apparatus. With cerebellar lesions there may be *hypermetria*, *asynergy*, *adiadokokinesis*, tremor, disturbances in speech, atony or hypotony, catalepsy, hemiparesis, fixed attitude of the head. None of these occur with labyrinthitis.

Cerebellar lesions, however, may have in common with disturbances in the vestibular apparatus abnormalities in the voluntary movements of the trunk and of the extremities. When these disturbances in movements result from disease in the labyrinth or in the

vestibular nerve, they are dependent for their direction on two elements, first, impulses from the static labyrinth, and secondly, impulses from the muscles and joints of the neck. Changes in these peripheral impulses cause alterations in the direction of the deviating movements. Thus, if, as a result of labyrinthine disturbance, a person has a spontaneous nystagmus directed to the right, when he attempts to stand erect he will fall to his left, if he faces forward. The tendency to fall, then, will be in the direction of the slow component of his spontaneous nystagmus. If, however, the afferent impulses to the cerebellum from the muscles and joints of his neck are changed by turning his face to one or the other shoulder, there will occur a change in the direction toward which he tends to fall. If this objective imbalance is due solely to a pathologic disturbance of the vestibular impulses, the tendency to fall will always be in the direction, in space, of the slow component of the resulting nystagmus. This relationship between the spontaneous nystagmus and the deviations is constant and characteristic of labyrinthine lesions and applies to the extremities as well as to the trunk. In the presence of a nystagmus of vestibular origin to the right, the arms held stretched out in front of the body will deviate to the left and the direction of this deviation will change with alterations in the position of the head.

On the contrary, the objective disturbances of balance due to cerebellar lesions, that is, the falling and the deviations of the extremities, bear no definite relationship to the spontaneous nystagmus if this be present. It is believed, although by no means proved, that the vermis of the cerebellum has to do with what Edinger called the statotonus; that is, the development of such tonic influences to the voluntary muscles as cause the body to be held erect in space. In disease of the vermis there is a disturbance of body balance and a tendency to fall, usually toward the side of the lesion. The direction of this tendency to fall is cen-

tral in its origin and is not influenced by changes in the peripheral impulses. Thus a person who has a positive Rhomberg, falling to the right, as the result of a cerebellar tumor, will fall to the right irrespective of any changes in the position of his head. Furthermore, a spontaneous nystagmus often accompanies cerebellar lesions, and if this is present, the direction of the falling will not of necessity be to the side of the slow component. What has been said regarding the tendency to fall applies equally to the deviations of the extremities.

So that, with regard to their influence on voluntary movements, the chief differential point between cerebellar lesions and vestibular lesions lies in the fact that in the former the falling and the deviations of the extremities are central in origin and their direction is not influenced by changes in the peripheral or afferent cerebellar impulses, whereas in the latter, changes in these peripheral impulses, aroused by changes in the position of the head, cause alterations in the direction of both the falling and the deviations.

With cerebellar lesions, in addition to spontaneous falling and deviations of the extremities, there may be a loss of the reaction movements which occur normally in response to artificially aroused vestibular impulses.

The response to functional tests in the presence of labyrinthine suppuration, that is, the loss of hearing, the loss of reaction to the caloric, rotation and fistula tests with the spontaneous nystagmus, etc., are so familiar that they require merely mention here. I dare say that all those who have performed the functional tests of the static labyrinth in the presence of cerebellar tumors or abscesses have seen the so-called enduring nystagmus. With cerebellar lesions a caloric nystagmus directed to the side of the lesion frequently lasts much longer than the normal two and one half or three minutes. This phenomenon is believed to be due to the loss of the inhibitory influence of the cerebellum on the vestibular centers. In two cases in

which large hernias of the cerebellum occurred after decompression operations in the posterior fossa I attempted by firm pressure on the hernia, after the manner described by Barany, to influence the duration of the caloric nystagmus directed to the affected side. In one of these I was successful, but in the other I failed, the nystagmus lasting the normal two or two and one half minutes.

I have purposely left for the end of this paper the consideration of the spontaneous nystagmus which sometimes accompanies cerebellar disease. As the result of our experience in the intervening time Dr. Braun and I, in our book on cerebellar abscess recently published, have reiterated a statement made about two years ago in a paper read before the neurologic section of the New York Academy of Medicine, namely, that the nystagmus of central origin often cannot be differentiated clinically from that due to labyrinthine disease. We have been unable to recognize any essential difference between the nystagmus of central origin and that due to disease of the labyrinth or vestibular nerve. That there are minor differences is evident. Grey, in his report of cerebellar cases from the Peter Bent Brigham Hospital, although agreeing in the main with the statement above, calls attention to the fact that in their experience the nystagmic movements are coarser with subtentorial lesions. It is true they are often more like the caloric nystagmus which one sees in the blind. With acute diffuse labyrinthitis the nystagmus is almost invariably directed to the opposite side. With cerebellar lesions the direction of the nystagmus may vary at different times. Neumann has shown that this occurs with cerebellar abscess. With tumors the direction of the nystagmus may vary sometimes with changes in the position of the head. Furthermore, with tumors it is more common to observe a nystagmus in the arteroposterior vertical plane. I have never seen this with vestibular lesions. But in the fact that it is a rhythmic movement of both eyes

and in the planes in which these movements occur with the exception cited above the nystagmus of central origin is essentially identical with that of peripheral origin.

There is, however, a considerable difference in the behavior of the two. The nystagmus with diffuse labyrinthine disease grows appreciably less in intensity from day to day, while that of central origin remains the same or may even increase in intensity.

Finally the attempt to consider the nystagmus of central origin as an oscillation, an asynergia to be differentiated from that of peripheral origin by the fact that in the latter the eye movements decrease on fixation of the vision, is not borne out by our experience. We have but recently seen a circumscribed labyrinthitis, a diffuse labyrinthitis and a fracture through the labyrinth, in all of which the spontaneous nystagmus was definitely increased on fixing the vision on the index finger held close to the patient's nose, and while this is, in all probability, not the rule, it is, at all events, too frequent an occurrence to be useful as a means of differentiation.

THE IMPORTANCE OF AURAL SYMPTOMS IN THE EARLY DIAGNOSIS OF TUMOR OF THE CEREBELLOPONTILE ANGLE

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The eighth nerve, comprising the auditory and the vestibular, from a diagnostic surgical standpoint, may be divided into three portions: the *peripheral*, comprising the end organs in the labyrinth; the *intradural*, extending from the fundus of the internal auditory meatus to its entrance in the groove between the pons and the medulla, and the *intracerebral* ramifications of its tracts in the brain to its cortical centers in the temporosphenoidal lobe and cerebellum.

The sudden and commanding character of the symptoms in inflammation of the cochlea and semicircular canal are due largely to the small, inelastic walls of the containing bony labyrinth, compelling an immediate paralysis of the function of the delicate nerve structures; their bony case not allowing the gradual development of symptoms from slow increasing pressure on the nervous structure, which frequently occurs in nervous tissue elsewhere. (The greater resistance of the auditory portion in the labyrinth in serous labyrinthitis with the preservation of hearing after the complete abolition of the vestibular function is, however, somewhat of this nature.)

After the entrance of the eighth nerve into the pons, its proximity to other vital centers generally causes the aural symptoms to be immediately overshadowed. The diagnostic symptomatology of lesions involving the intracerebral portion of the auditory nerve is but

rarely recognized, although in my experience such lesions are far from uncommon.¹

In the passage of the eighth nerve, through the small space from the fundus of the internal auditory meatus to the medulla, across the posterior border of the middle peduncle of the cerebellum, the nerve, while intradural, is still extracerebral, and, being in a free space, may escape for a long time a paralyzing pressure from a tumor of the cerebello-pontile angle.

Many cerebellopontile angle tumors, especially dural endothelioma and neurinoma,² are of very slow growth, and disturbance of hearing and of the vestibular apparatus of the affected side are frequently the only symptoms of which the patient complains, the aural often preceding other symptoms for months, and sometimes for years.³ On the recognition of the intracranial origin of the aural symptoms may depend the success of surgical intervention, and the reputation of the aurist. I know of many instances where after weeks and months of unsuccessful inflammations and local treatments, the development of a papilledema has first called attention to the true cause of the deafness (Fig. 1).

In studying the aural symptoms of cerebello-pontile angle tumors, it should be remembered that they are but a modification of the acute aural manifestations so frequent in fracture of the base of the skull, extending through the petrous portion of the temporal bone. The end-result of compression of the eighth nerve, whether from fracture or tumor, is the same, namely, loss of function, deafness and loss of vestibular reactivity. However, in one, the function of the vestibular apparatus of one side is suddenly upset; but, *in tumor, the slow pressure on the nerve allows of*

1. Starr: Jour. Nerv. and Ment. Dis., 1910, xxxvii, 401. Guthrie: Jour. Laryngol., Rhinol. and Otol., 1915, xxx, 177. Weinland: Arch. Psychiat., xxvi, 375. Campbell: Histological Studies in Cerebral Localization, London, 1905. Mills: Jour. Nerv. and Ment. Dis., February, 1912.
 2. Healy: Jour. Nerv. and Ment. Dis., 1909, xxxvi, 229; Henneberg and Koch: Arch. Psychiat., xxxvi, No. 1.
 3. Wimmer: Six Cases of Acoustic Nerve Tumors with Operation, Hospitalstidende, September, 1914, p. 1169. Schmiegelow: Ztschr. f. Ohrenh., July, 1915.

a readjustment of the vestibular apparatus during the process of compression.

In fracture there are suddenly: (1) tinnitus and deafness; (2) loss of vestibular reactivity, associated with (3) vertigo; (4) spontaneous nystagmus away from the affected side, and (5) spontaneous pointing deviations of both homolateral and contralateral extremities toward the side of the lesion. The deafness and loss of vestibular reactivity are permanent, but the nystagmus, dizziness, and spontaneous pointing deviations rapidly disappear. The transient vestibular manifestations, the dizziness, nystagmus and spontaneous pointing deviations result from a total, sudden loss of function of the vestibular apparatus of the affected side, and the early abolition of these symptoms is due to a readjustment of the vestibular system, as a whole, to meet the changed condition.

It is through *the same* readjustment in the vestibular apparatus (*of the opposite as well as the affected side*) which, in the acute cases, so early abolishes the spontaneous nystagmus, pointing deviations and dizziness, that the slowly growing cerebellopontile angle tumors may first manifest themselves.

We have at our command for the early diagnosis of intracranial disturbances of the eighth nerve: (1) functional examination of the auditory portion, and (2) functional examination of the vestibular portion.

So important is a complete and systematic routine functional examination of the eighth nerve, that all patients presenting themselves with disturbance of hearing or equilibrium should, because of the time consumed and the part played by the personal equation, be delegated for examination to a specially trained attendant.

This routine examination by an attendant in my office consists, for the auditory portion, in ascertaining: (1) the hearing distance of the (*a*) watch, (*b*) whisper, and (*c*) voice; (2) the lower and upper tone limits and the measuring of their respective durations;

(3) the Rinne-positive or negative; (4) reference of the Weber at both vertex and teeth, and (5) the measurement of the duration of the bone conduction.

The routine examination of the vestibular apparatus consists of ascertaining: (1) the presence or absence of spontaneous nystagmus. If from the above I suspect labyrinthitis or intracranial involvement, the attendant further (2) examines the spontaneous pointing of both arms and legs, and (3) explains to the patient the caloric test: (*a*) its inconveniences, such as vertigo, possible nausea and vomiting; (*b*) the short duration, during induced nystagmus, of the pointing deviation and falling, and (*c*) its successful application, largely depending on the patient resisting the natural tendency to close the eyes. (*d*) The attendant then proceeds to the repeated rehearsing with the patient of the pointing and falling positions.

When the patient thoroughly understands what is required of him (4) the cold caloric test is applied in my presence, and during it is noted: (*a*) the induced nystagmus; (*b*) the rapidity of its induction; (*c*) whether it is associated with vertigo or a sensation of dizziness; (*d*) the pointing deviation for both arms and legs during the induced nystagmus, and (*e*) the falling tendency.

If the patient has been thoroughly drilled by the attendant prior to the application of the caloric (cold), it is remarkable how little time is consumed and how much can be ascertained in the few seconds of an induced nystagmus.

In cerebellopontile angle tumors growing from the dura, endothelioma, or attached to the acoustic nerve, neurinoma or fibroma molluscum, one of the first symptoms complained of is a slight deafness with a distressing tinnitus. Routine examination with the tuning forks may make an early diagnosis of an intracranial origin by (1) a reduction of the duration of the bone conduction of the affected side; (2) the referring of Weber to the unaffected side; (3) a positive Rinne

on the affected side, and (4) frequently greater alteration of the tuning fork reactions than is accounted for by the amount of the loss of hearing.⁴

All these are too well known to be discussed. In the vestibular apparatus, however, many problems are still in the realm of speculation.

Spontaneous nystagmus is generally associated with tumor of the cerebellopontile angle when the tumor causes compression of the cerebellar cortex, but its slow growth frequently allows of considerable displacement of the cerebellum without nystagmus; in fact, the slowly progressive deafness has, as a rule, long passed into total deafness before the development of nystagmus, by which time a papilledema from increased intracranial pressure may have also appeared. Spontaneous nystagmus is apt to be a late manifestation of tumor originating in the cerebellopontile angle, in contradistinction to tumors growing into it from the cerebellum.⁵ Spontaneous nystagmus is also present in a certain proportion of tumors situated in the cerebrum,⁶ in which case, however, there will be no disturbance of the auditory apparatus, the hearing and the tuning fork reactions being normal.

Again, in intracerebellar growths, glioma, not involving the cerebellar cortex, spontaneous nystagmus may be entirely absent, although the growth may have attained considerable size; but in these also the tuning fork reactions are apt to be normal, deafness not usually being present.

Spontaneous Pointing Deviations. — Spontaneous deviations are, in my experience, very rare during all stages of cerebellopontile angle tumors or intracerebellar lesions of slow development, in contrast to their presence in the early stages of acute lesions, fractures and abscesses. Especially in those cases not associated

4. Holinger: Tr. Ninth Otol. Cong., p. 494.

5. Weisenburg, T. H., and Work, Philip: The Diagnosis of Tumors in the Posterior Cranial Fossa, *THE JOURNAL A. M. A.*, Oct. 16, 1915, p. 1345.

6. Grey, E. G.: Studies on the Localization of Cerebellar Tumors, *THE JOURNAL A. M. A.*, Oct. 16, 1915, p. 1341.

with a spontaneous nystagmus are spontaneous deviations uncommon. In cases associated with nystagmus, slight deviations from the normal are frequently present, but the deviations are very irregular and variable in their appearance, my experience confirming Grey's⁷ observations.

Pointing Deviations During Induced Nystagmus from Cold Caloric.—In cerebellar abscess during an induced nystagmus, there is frequently an absence of the normal pointing deviation of the homolateral side, but in cerebellar growths, deviations are variable. I believe that in small tumors (especially those confined to the auditory nerve, as in a case observed by me of fibroma molluscum, causing complete deafness, and three years later involving the opposite ear) no alteration from the normal pointing deviations will be present. In the larger growths of the angle and those originating in the cerebellum and growing into the angle, the interference with the normal pointing deviations will depend on the tumor being extensive enough to interfere permanently with the functioning of the cerebellar cortex or tracts of the different parts.

In increased intracranial pressure from disturbances of the cerebrospinal fluid system, variations in the degree of increase may cause variable pointing deviations, they being at one time absent and again present (Fig. 2).

Vestibular Reactability of the Unaffected Side.—The diagnostic assistance obtained from the cold caloric of the ear on the opposite side to the lesion has been of the greatest value in cerebellopontile angle tumor. In cases of partial deafness of one ear, cold caloric applied to the unaffected ear uniformly gave a *greatly diminished reactability*.⁸

After the deafness has become complete and symptoms of increased intracranial pressure, such as

7. Grey, E. G.: *Am. Jour. Med. Sc.*, 1916, cli, 693.

8. All caloric tests were made with patients seated in an upright position.

papilledema, present themselves in my experience, it is frequently impossible to induce nystagmus by the syringing of cold water into the ear of the unaffected side; and if a slight nystagmus is induced, it is unaccompanied by vertigo or vomiting, at most a slight sensation of momentary giddiness being complained of. Also in the early cases in which hearing of the affected side is still present, while syringing of cold water in either ear induces a slight nystagmus, this nystagmus is not associated with vomiting or vertigo, but generally with a "floating" or swimming sensation of very transient duration.

The value of the diminution of the vestibular reactivity of the unaffected side, as a sign of increased intracranial pressure, was originally stated⁹ in a communication to the American Otological Society in June, 1912. Confirmation of this observation has frequently occurred since that date.

Examination with regard to the reactivity of the vestibular apparatus in patients suffering from marked internal hydrocephalus, the result of intracerebellar tumors, may give very conflicting findings at different examinations.

Figure 2 shows a large intracerebellar glial cyst, with marked secondary hydrocephalus. The child was repeatedly examined during a year and a half prior to death. Spontaneous nystagmus was never present, and the spontaneous pointing deviations observed were too slight and transient to be definite. She was repeatedly subjected to the cold caloric. During a violent headache, doubtless due to a disturbance of the constantly present internal hydrocephalus, it was impossible to induce nystagmus or pointing deviations; a day later, however, cold water in either ear easily induced nystagmus, associated with normal pointing deviations and falling tendencies; but the nys-

9. Eagleton, W. P.: Decompression for the Relief of Disturbances of the Auditory Apparatus of Intracranial Origin. Report of Three Cases with a Previously Undescribed Aural Condition, *Laryngoscope*, 1912.



Fig. 1.—Large endothelioma springing from dura, causing great compression of cerebellum. Aural symptoms were present for years prior to general symptoms of tumor.





Fig. 2.—Small tumor with large secondary cyst of cerebellum causing great hydrocephalus. During life, spontaneous nystagmus was absent. Vestibular reactivity was at times present and again absent.

tagmus was never associated with a subjective sense of vertigo, or with vomiting.

It would seem, then, that alterations in increased intracranial pressure influences the possibility of the production of an induced nystagmus and of associated pointing deviations, abolishes the vomiting so often associated with the cold caloric, and lessens to a marked degree the subjective discomfort of dizziness.

The absence, following cold caloric of vertigo (the only complaint frequently being a transient giddiness) and vomiting, with a reduction of the vestibular reactivity of the unaffected side, may probably be regarded as symptoms of an increased intracranial pressure.

It would appear, therefore, that the aural manifestations of cerebellopontile angle tumor are : (1) progressive deafness, beginning with a disturbance of the proper relationship between the degree of hearing and the tuning fork reaction, especially the duration of the bone conduction to the degree of deafness, and ending in (2) total deafness; associated with (3) loss of vestibular reactivity of the affected side; and during the time that the vestibular apparatus is still functioning (4) a gradual readjustment of the vestibular apparatus of the contralateral as well as the homolateral side is going on, which is manifested by (a) a reduction or even a temporary abolition of its reactivity to the cold caloric (at least when applied in the upright position); (b) an absence of the vertigo and vomiting which normally accompany the induced nystagmus from the cold caloric, and (c) absence of spontaneous pointing deviations. As the cerebellar cortex becomes affected, however, may be added: (5) spontaneous nystagmus; (6) spontaneous pointing deviations, and (7) absence during an induced nystagmus of the normal pointing deviations of the homolateral side.

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ABSTRACT OF DISCUSSION

ON PAPERS OF DRS. PHILLIPS, FRIESNER AND EAGLETON

DR. HORACE NEWHART, Minneapolis: I wish to emphasize the importance in all suppurative cases, of making regular, systematic examinations of the labyrinthine and cerebellar functions. By doing so we could undoubtedly reduce materially the mortality which exists with all endocranial complications of otitic origin. Take the statistics for cerebellar abscess. Unoperated, the mortality is practically 100 per cent. while the records of those best fitted to operate in such cases show a mortality of 40 per cent. Patients with cerebellar abscess too often come under observation in the latter stage of the manifest period, when interference cannot be expected to yield better results than those stated. But there is another group of cases, including the many chronic cases of temporal bone involvement, and the acute suppurative cases, if we were to apply to these our regular routine tests of the labyrinthine and cerebellar functions, we should gain some light as to what is going on within the cranial cavity, and by early operation might safely intervene before the appearance of a diffuse meningitis, with very appreciable reduction in mortality. Of great assistance in making a diagnosis of endocranial complications are the results of ophthalmoscopic and ocular examinations. Alexander, Neumann and O. Ruttin stated that in at least 50 per cent. of cases of cerebellar involvement originating in the labyrinth, there are changes in the fundus. These changes are not always marked; only in the later stages, with decided increased endocranial pressure, is there a true choked disk. But the distinct alteration of the retinal vessels, usually unilateral and corresponding to the side involved, are sufficiently constant to be of diagnostic value. Disturbances arising from increased pressure affecting the cranial nerves come relatively late, but it is not unusual to find a diplopia with cerebellar abscess. In three cases coming under observation during the past six months, all terminating fatally, from several days to two weeks before a diagnosis of a terminal meningitis was made, the patient had complained of distinct throat symptoms with painful deglutition, and this without any discoverable lesion of the throat. This suggests somewhat the possibility of very early bulbar irritation associated with these cases of endocranial complication in the posterior fossa.

DR. ISAAC H. JONES, Philadelphia: A woman was referred to me with a diagnosis of tumor of the right cerebellar hemisphere. It was evident that either the ear tests were incorrect or there was nothing the matter intracranially. The right ear responded poorly; douching the left with both hot and cold water showed normal nystagmus and normal past-pointing in both directions, suggesting normal brain stem and

cerebellum. Operation was postponed, she became perfectly well, has had a baby and has remained in perfect health ever since. Unquestionably it was a labyrinthitis and not brain tumor. A man getting off a train has a sudden explosive sound in his ear, falls to the platform, is dizzy and sick in bed for a week. Right ear is stone deaf, static and cochlear. Wassermann markedly positive. Could anything be simpler to diagnose—destruction of the labyrinth? But it was nothing of the sort, it was a beginning acoustic tumor. Later he showed spontaneous vertical nystagmus upward, which together with absence of responses from one ear make the diagnosis of cerebellopontile angle tumor with pressure on the brain stem. Necropsy showed cerebello-pontile angle cyst. Man, neurological diagnosis, right frontal tumor; ear tests suggested left cerebello-pontile angle tumor. However, they operated in the right frontal region. Necropsy showed left cerebello-pontile angle tumor. An apparently healthy man with headache showed normal labyrinths and eighth nerves and yet the vertical canals failed to produce any responses; horizontal canals produced normal nystagmus but no vertigo. This phenomenon-complex indicated pressure within the fourth ventricle; this diagnosis appeared ridiculous because the man seemed in such perfect health. That night he was rushed to the hospital unconscious; next day he regained consciousness but complained of agonizing headache. Many physicians and neurologists pronounced it hysteria. We stuck to our conviction of an organic lesion in the fourth ventricle. Necropsy three days later showed abscess in the fourth ventricle. Internal hydrocephalus shows absence of reaction from vertical canals and impaired vertigo from horizontal canals. Our operative and postmortem findings suggest that the horizontal canal fibers are confined to the medulla and inferior cerebellar peduncle, whereas vertical canal fibers traverse the pons and middle cerebellar peduncle. Cerebello-pontile angle tumor shows (1) "Crossed" past-pointing; both arms point inward or both arms point outward regardless of type of stimulation. (2) Not only is there total absence of reaction from ear on the side of tumor but vertical canals of opposite ear fail to produce responses, whereas horizontal canal of opposite ear gives normal reactions. This is due to pressure on the pons involving vertical canal fibers from opposite ear. In one case a decompression was done and then stimulation of the opposite side gave normal responses, showing clearly that pressure had been removed from the vertical canal fibers.

DR. J. HOLINGER, Chicago: It seems to me that we have become too sanguine by the results of the examination of the static labyrinth, and are prone to forget the examination of the ear by means of the speculum, and tuning forks. The statistics of brain tumors show that tumors of the acoustic nerve are not very rare, yet they are very rarely

diagnosed. Tumors of the acoustic nerve are only discovered at the necropsy. As to a division of the nerve supplies of the horizontal and the vertical semicircular canals, the same is true of the vestibular and cochlear nerves. This division may also give us pointers in trying to locate a tumor, as well as the division of the nerve supply of the horizontal from vertical canals. All of these points are equally important in fractures of the base of the skull, and in locating a blood-clot. The following incident may be of interest: Last December I saw a patient who had had a fall on a slippery sidewalk, after which he got up and walked home. A few days later he became drowsy. When I examined him his mind was not clear, but he still reacted to some questions, slowly and loudly put, and several times repeated. The examination by means of speculum and tuning fork allowed me to make a diagnosis of fracture of the base, running from the external canal of the right ear, crossing the pyramid of the temporal bone and following the course of the eustachian tube. Meningitis. Caloric test was contraindicated, the fluid might have gone into the skull cavity. Three days later the patient died, and I was requested by the coroner's jury to hand in a report independent of the coroner's postmortem report. A colleague who followed the whole proceedings told me afterward that my description of the fracture was more accurate than the coroner's.

DR. GEORGE W. MACKENZIE, Philadelphia: I wish to endorse practically everything Dr. Eagleton said, particularly in reference to the early symptoms that are possible of solution by careful otologic examination in cases of brain tumor long before there are symptoms of marked intracranial pressure, and, too, in reference to basal fractures. In cases of basal fracture, Bezoldt found that one-fourth of the fractures involve the temporal bone. A basal fracture may involve the middle ear alone, the internal ear alone, or both combined. In a case of basal fracture involving the middle ear alone, functional tests disclose the typical findings of involvement of the conducting apparatus. When the inner ear is involved, there are the typical findings of a disease of the perceiving apparatus; furthermore, when the inner ear is involved, the facial nerve is usually involved with it. It is important in all cases of basal fracture, therefore, to make a careful examination of the hearing function as well as the static function since it gives us an important guide as to the prognosis and method of operation to be followed. I recall one instance where a general surgeon removed the stirrup in a case of fracture of the tegmen tympani, causing a pronounced deafness that would not have followed had the stirrup been left alone. On the other hand, there are many cases of fracture through the labyrinth, that could be operated successfully, which are allowed to go on to meningitis and death simply through neglect to

operate. I believe that all cases of fracture involving the base should be examined carefully by the otologist and in case the temporal bone is involved, I would urge that the otologist perform the operation rather than leave it to the general surgeon. I also want to mention a case in which I had diagnosed a tumor of the internal auditory canal, involving the seventh and eighth nerves. I suggested the diagnosis of cysticercus, because the man had lived among dogs all his life. In the decompression operation done later by a general surgeon, a great portion of the occipital bone was removed and the tumor not reached. The patient died a short time after from shock. The postmortem examination proved the correctness of my diagnosis. Had this case been operated by an otologist following the method of removal of the labyrinth, slightly modified, the results would have been more favorable. My plea is for accuracy in methods of examination, using what knowledge we have concerning the functions of the inner ear and their deviations from the normal when they are involved. One of the gentlemen mentioned that a patient had a nystagmus to both sides. There is no lesion of the vestibular apparatus or cerebellum that can produce a nystagmus to the two sides. Where such findings are recorded, it is because of a mistaken observation. Nystagmus of reflex origin is always in one definite plane and direction and should be observed with the patient looking straight ahead while the eyes are in condition of rest. When we record our observations in nystagmus in the side positions, we are bringing in an additional factor which has nothing whatever to do with the reflex.

DR. LEWIS FISHER, Philadelphia: In the analysis of cases showing vestibular symptoms, in order to get as clear a conception of this subject as possible, we attempt to visualize the anatomy of the parts concerned. We believe that the vestibular apparatus starts at the internal ear, and is connected with the various portions of the central nervous system by means of nerve paths. The internal ear, however, is by far the most important portion of this vestibular apparatus. Disturbances in equilibration cannot occur unless there is interference with this vestibular apparatus at some point. The same can be said of nystagmus, it can occur only when there is disease along the fibers which run to the eye muscles producing nystagmus. We try to remember that in the internal ear as well as in the eighth nerve, apart from the acoustic fibers, there also run two other sets of fibers, one set to the eye muscles producing nystagmus, and another to the cerebral cortex, producing dizziness. But these paths do not run together all the way; in the brain stem they part company. The nystagmus fibers run to the eye muscles, while the fibers carrying the vertigo stimuli have the cerebellum as their first objective point. These paths are different for the two sets of canals. The horizontal canal

fibers enter the cerebellar nuclei by way of the restiform body, and from there, leaving by way of the superior cerebellar peduncles, go to the temporal lobes of the cerebrum. The vertical canal fibers continue higher up in the brain stem and enter the cerebellum by way of the middle cerebellar peduncle. There is always an inseparable association in the minds of authors between nystagmus and past-pointing. Bárány in his writings says that certain deviations in pointing occur in relation to either one component of the nystagmus or the other. This is to be greatly regretted. We have shown by experiments at the University of Pennsylvania that the slow component of the nystagmus has absolutely nothing to do with the dizziness and past-pointing that we are able to induce in patients by stimulating the labyrinth. When such a relation appears it is simply a coincident. Thus: The rule as generally postulated, namely, that the past-pointing is in a direction opposite to that of the nystagmus is not correct, for we have shown that if an individual is turned to the right with the head back, the resulting nystagmus is to the right, but the past-pointing is also to the right, and we believe that this subject could be greatly simplified, if this differentiation between the two reactions were more generally understood. In cerebral abscess, or tumor of the brain stem, or of any portion of the brain all the vestibular phenomena are produced either by irritation or by destruction of some of the vestibular fibers. In patients exhibiting such vestibular disturbances only a careful examination of the ear can tell us whether the disturbance is in the labyrinth and eighth nerve or whether it is intracranial. If in the latter, we are able to tell just where within the cranium these pathways have been interfered with. For example, if in a case presenting vestibular symptoms we are able to produce nystagmus but no vertigo with past-pointing, we know that the disturbance must be in the vertigo pathways between the cerebellar peduncles and temporal lobes. If on the other hand, we stimulate the labyrinth and are able to produce dizziness with past-pointing but no nystagmus, then, the interruption must be either in the pons or medulla oblongata. Generally speaking, a careful examination of both labyrinths, and especially of each canal separately enables us to test the integrity of the different pathways and locate lesions with considerable accuracy.

DR. CHESTER C. COTT, Buffalo: Tumors which press on the auditory nerve or involve this nerve in its growth often cause a sudden onset of symptoms. This is due to the fact that the resistance of the nerve is suddenly overcome. Before the onset of severe symptoms an examination would reveal cochlear nerve degeneration. Later there occurs a severe attack of dizziness very likely following a trauma which the patient usually ascribes as the cause.

DR. ISIDORE FRIESNER, New York: In addition to the anatomic reasons for the priority of auditory symptoms in tumors not only of the cerebellum or pons, but also of the nerve, we must not forget that there is a very marked difference in the viability—and conversely in the destructibility—of the two branches of the eighth nerve. Not only is this true as far as the nerve trunk itself is concerned when subjected to pressure or involvement by a tumor mass, but Alexander has shown, from the examination of labyrinths which were subject to suppurative process, that this difference extends completely throughout the labyrinth itself. For instance, the hairs, which are biologically distinct from the hair cells, show a difference in viability when they are subjected to the presence of pus in the intralabyrinthine cavities. So with the tumor which involves, as far as its gross structures are concerned, the auditory and vestibular nerves equally, the primary disturbance will be in the auditory function—tinnitus or deafness. Furthermore, there have been reported numerous cases where in addition to the eighth the facial nerve was involved, and yet there was no paresis. So that in the order of their susceptibility we consider the auditory nerve, but second the vestibular, and last, the facial. In regard to nystagmus to both sides, it is true that in many of these cases the nystagmic movements are more marked to one side than to the other. With brain tumors, however, I have seen a vertical nystagmus directed not only upward but also downward. Of course this cannot be a physiologic nystagmus. It is a rhythmic movement of both eyes, and if we do not call this nystagmus both upward and downward, I do not know what we should call it.

DR. WELLS P. EAGLETON, Newark, N. J.: We have all seen cases where the otologists should be called in. Our general hospitals are crowded with otologic cases. Every neurologic ward has its otologic problems, and we could give great assistance there, if we could see the cases in time to make an early diagnosis.

THE METHOD OF TONSILLECTOMY BY
MEANS OF THE ALVEOLAR EMINENCE OF THE MANDIBLE
AND A GUILLOTINE

AFTER SIX YEARS' EMPLOYMENT *

GREENFIELD SLUDER, M.D.

ST. LOUIS

The history of tonsil surgery is clear beginning with Celsus, 10 A. D.¹ He describes finger enucleation and sharp knife enucleation. Surgeons of the middle ages at times did tonsillotomy and at one time used a ligature, for probably a tonsillectomy, by sloughing. The first push blade guillotine was introduced in 1827 by Physic for tonsillotomy. The pull blade guillotine of Fahnestock in 1832 was also for tonsillotomy.² I have not been able to determine when blunt dissection or dissecting and snaring was introduced. I described guillotine enucleation to this society June 9, 1910.

The various enucleation procedures are summed up under the headings of (1) the finger dissection, (2) the sharp knife dissection, (3) dissection and snaring, and (4) guillotine dislocation.³ Blunt dissection may be classed as a subdivision in the finger or sharp dissection classes. For the finger dissection the instrumentarium has remained unchanged. For all other methods it has been greatly multiplied and greatly complicated. Many small modifications have also been introduced in the primary subdivisions of methods.

* I gave it this name and described it in detail in the original text: Sluder, Greenfield: A Method of Tonsillectomy by Means of a Guillotine and the Alveolar Eminence of the Mandible, *THE JOURNAL A. M. A.*, March 25, 1911, p. 867.

1. McKenzie, Morell: *Diseases of the Throat and Nose*, London, 1880.

2. The scheme of the guillotine is much older than these dates as brought forward recently by Dr. Stanton Friedberg in a scholarly historical sketch of the instrument (*Ann. Otol., Rhinol. and Laryngol.*, 1913).

3. This classification was first made by G. L. Richards.

The antiquity of the first three, together with the infinite variation and multiplication of the instruments and the almost infinite (and growing) small variations in their technic is to me proof that the "standard (100 per cent.) tonsillectomy," as recently proposed, has not yet been attained by the enthusiastic advocates of any one of them. I do not believe a standard (100 per cent.) tonsillectomy can exist.

A discussion of methods may be concluded with the suggestion that each surgeon should employ that which he is best able to execute. For those satisfied with none of the older ones, and for those in their developmental years, when they must learn *some* method, the guillotine technic offers the advantages of (1) speed, (2) minor (or any) anesthetic (nitrous oxid⁴), (3) better cosmetic results as a rule, (4) small bleeding, and (5) performance by the sense of touch independent of sight.

The principle on which it rests is that the tonsil by means of the firm metallic ring placed behind and below it is dislocated forward and upward or upward and forward to a place where it may be manipulated by the finger tip. The point of vantage to which it has been brought is the alveolar eminence of the mandible, made by the last formed tooth in its socket. Below, the eminence is limited by the mylohyoid line. On the civilized jaw, the body below the line usually presents a concavity of more or less depth. On the aboriginal American Indian's jaw usually this is almost or quite absent. The body is heavier and forms with the eminence usually a broad convexity, ending below with the lower line of the jaw. Such a jaw permits of this tonsillectomy being performed with one hand. The finger tip is not needed to help push it through. All degrees of intermediate modification exist. On edentulous civilized jaws, the combination of the absence of alveolus with the concavity below the line makes a

4. The special advantages of nitrous oxid for this surgery were emphasized by C. A. Gundelach (Interstate Med. Jour., November, 1911).

set of conditions that should be carefully borne in mind by the surgeon. The ring of the guillotine for such a case should be thin in order to get into the concavity and scoop out the (usually) small fibrous adherent tonsil. The aperture should be small in order better to manage the tonsil on the remnant of the eminence.

Easy cases may be managed often by a surgeon who has only a hazy memory of this anatomy; but as the difficulties of the case increase, so does the necessity of accurate knowledge of this anatomy and its variations. In this connection I feel that it is most desirable to emphasize again this structure and its changes according to age. Figures 1 to 7 show jaws from early childhood to age. In order to get the tonsil into the



Fig. 1.—Jaw bone from 4½ to 5 years. Internal surface.

ring it is plain that with the younger jaws the guillotine must cross the mouth at a (varying) greater angle. It is also to be observed that in order to utilize the eminence to most advantage the long (transverse) axis of the ring must be parallel to the long axis of the eminence. This necessitates the shaft of the guillotine taking as its final direction 45 degrees downward from the line of the alveolus regardless of what may be its outward and backward direction. As stated above, the outward angle increases with the youth of the patient.

From a considerable observation of surgeons using this technic, with opportunity to see their difficulties and failures, I feel that the importance of this final downward turning of the shaft cannot be too much emphasized. It permits a certain hold of the lower part of the tonsil on the eminence, while the upper part

may be accurately manipulated by the finger tip; otherwise the lower part escapes the blade. The surgeon who fails oftenest is the one who keeps the shaft nearly parallel with the alveolus. He seems to forget to take his bearings on the mandible. As soon, however, as he has been shown the final downward angle for his shaft, his difficulties become less and his failures fewer. An operator of reasonable skill then soon learns to remove any tonsil under any conditions, provided he bears in mind the possible changes in the eminence, and his instrument is one that lets him work to best advantage.

The greatest misfortune which has befallen this technic is the modifications of the instrument. The instrument which allows the surgeon the greatest



Fig. 2.—Jaw bone at 5 years. Internal surface.

advantage under all conditions and gives the highest percentage (99.6 per cent. perfect results), according to my understanding, is the original guillotine of Physic that has been adapted to these special usages. It should be strong with a thin elliptic ring and a dull blade, not blunt, but merely dull. The capsule of the tonsil will slip out from under a blunt blade even after it is properly engaged.

It is evident that for the purpose of dislocating the tonsil from its soft hollow bed and bringing it forward and upward or upward and forward, thereby to utilize the alveolar eminence as a more advantageous place from which it may be manipulated and put through the ring, a ring and shaft and handle are the essentials for the instrument. These features have been retained

in a large variety of modifications, which may be summarized as follows: those which retain the push blade and modify other parts, for example, (1) Sauer's⁵ set screw, Ballenger's⁶ handle and LaForce's⁷ instrument; (2) those which utilize a pull blade, as Jennings's⁸ instrument, and (3) those in which a snare wire is substituted for a cutting blade, as Beck's⁹ instrument and its modifications.



Fig. 3.—Jaw bone from 8 to 10 years. Internal surface.

The original simplest model to my mind has the great advantage that it allows the freest movement of the wrist and at the same time retains the strength of the flexors. It also provides a rigid closing ring, whose still point is on the eminence. All modifications sacrifice more or less both of these advantages. When the movements of the wrist are interfered with, the certainty of performance is decreased and the possibility of removing small pieces that may escape the first application of the instrument diminishes, and the management of peritonsillar infiltrates becomes less good. For these reasons the modifications again fall into three classes. Sauer's, Ballenger's and LaForce's lose because of their handles. (Ballenger's is the only one for which percentages have ever been given. He stated that it was good for 70 per cent. of the cases.)

5. Sauer, W. E.: Tonsil Guillotine with a Dull Blade, *THE JOURNAL A. M. A.*, May 4, 1912, p. 1335.

6. Ballenger, W. L.: *Diseases of the Nose, Throat and Ear*, 1912.

7. LaForce, Burdette: Haemostat Tonsillectome, *Laryngoscope*, 1914.

8. Jennings, J. E.: A New Tonsillectome, *THE JOURNAL A. M. A.*, May 24, 1913, p. 1620.

9. Beck, J. C.: Tonsillectomy With a Single Instrument, the Tonsillectome, *THE JOURNAL A. M. A.*, Jan. 27, 1912, p. 240.

The other modifications lose because they needs must pull away from the eminence as they come into action. Jennings's model has the advantage of a rigid ring which enables the surgeon to control the tonsil mass under the tip of his finger. This helps him to manage a peritonsillar infiltrate and scars, binding the capsule down. But it pulls away from the eminence as soon as it begins to work, which is a great advantage. Beck's instrument, which is a combination of Tyding's snare tip and Pierce's handle, has the disadvantage of pulling away from both the control of the eminence and the finger tip. Pieces which escape the first application of the instrument cannot be removed by Jennings's or



Fig. 4.—Jaw bone from 11 to 12 years. Internal surface

Beck's instruments. Furthermore, both are apt to leave, as a flaw in their performance, a ring of capsule with lymphoid tissue surrounding the wound. I believe this fault impossible of immediate repair by any means. To me it has also seemed the most unfortunate, clinically, because of lymphoid tissue reproduction from it sometimes filling the entire fossa.

An advantage possessed by this technic is that it may be done by sight or largely or wholly by the sense of touch. Dissecting methods must have clear vision, which may be at times difficult or impossible to get. The original guillotine has also the advantage of being the instrument which may be easiest and quickest mastered.

In my original presentation of this technic I made two mistakes. First, I gave the impression that was

simple and easy to execute. I have since concluded that that was most unfortunate. For one who will learn it, it is a matter of close study in anatomy, technic and touch. I say this now as a result of much teaching to undergraduates and graduates. Secondly, I spoke of the plica triangularis as a part of the anterior pillar, saying,¹⁰ "Further examination of the specimen reveals that a little of the free edge of the anterior pillar, including a few fibers of the palatoglossus muscle, is attached to it." The specimens usually show a red margin at the line where the plica is cut,

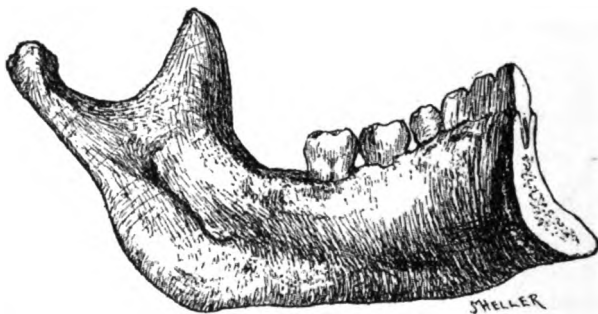


Fig. 5.—Jaw bone from 18 to 40 years. Internal surface.

which appears to be muscle, but under the microscope this is shown to be a mistake. At that time I considered the plica to be a part of the anterior pillar, but I now believe with Fetterolf¹¹ that it is a part of the capsule only that the pillar is made by the palatoglossus muscle. The pillar is preserved by this technic.

This method was developed in almost if not quite every detail by Drs. Whillis and Pybus¹² in England. We worked quite independently of each other, quite unknown to each other. They did not describe the anatomy of the jaw in connection with it or necessary to it.

10. Sluder, Greenfield: A Method of Tonsillectomy by Means of a Guillotine and the Alveolar Eminence of the Mandible, *THE JOURNAL A. M. A.*, March 25, 1911, p. 867.

11. Fetterolf: *Am. Jour. Med. Sc.*, 1912, i, 37.

12. Whillis and Pybus: *Lancet*, London, Sept. 17, 1910.

Since then the method in contradistinction to the instrumentarium has been modified twice. Drs. Hill and Elfick¹³ of England use the dislocation principle, but utilize the tubercle of the maxilla instead of the eminence of the mandible as the point of vantage from which to manipulate the tonsil. The hamulus of the pterygoid, however, is just back of the tubercle, which seems to me to be undesirable, as it is frail and might be broken. I have not seen the method used and so desire to emphasize that I make this suggestion only as a possibility. Dr. G. Hudson Makuen also has proposed a method for, as he says, "splitting the capsule." He uses the original model guillotine to secure the tonsil

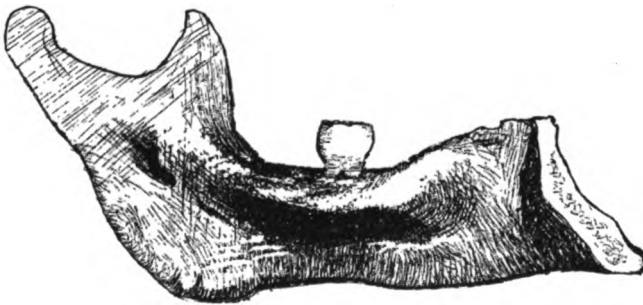


Fig. 6.—Jaw bone at possibly 50 years. Internal surface.

free from its surrounding structures just as in the original procedure, in readiness to "push the blade through." Instead, however, he places a snare wire around the engaged tonsil on the median side of the guillotine and then removes it by the snare. He has explained in detail how this splits the capsule, leaving a lateral layer in the fossa.¹⁴

The ring and the blade of the instrument are features of such importance that I feel certain points about them should be brought to your notice. The original text contains a mechanical drawing, to scale,

13. Hill and Elfick: Minimizing of Hemorrhage in Tonsil Extirpation and Employment of Hemostatic Tonsillectome Jour. Laryng. and Rhinol., 1914, p. 545.

14. Makuen, G. H.: Tr. Am. Laryngol. Assn., 1914.

of the guillotine (two sizes) specially adapted to these needs. They have never been changed save for the omission of the copper lining to the ring. The elliptic ring was thin and the blade ground back for 2.5 cm. It has, however, been so often changed by instrument makers in shape (round) and thickened and the blade ground short that I emphasize these faults, so the surgeon may—in fact must—know what is the correct model and not trust to the statements of the instrument makers' salesmen.

Should the ring be thick and the blade ground short there is, when they are closed, a sulcus between them much deeper than when the ring is thin and the blade



Fig. 7.—Jaw bone at very old age. Internal surface.

ground 2.5 cm. back. The deeper this sulcus is, the more difficult it is to feel what is at the bottom of it; and so it happens that small pieces of the tonsil or capsule may have escaped the setting of the instrument and be out of the reach of recognition by the finger tip. This is not true of a thin ring and long ground blade. Omitting the copper lining of the ring permits it to be made a little thinner.

Moreover, the thinner the ring the more certainly will it scoop up a small or soft or difficult tonsil or a tiny fragment that has been left. With a good ring and blade, all fragments are easily removed with the single exception of a small one near the uvula. A sur-

geon familiar with this point, however, never leaves this fragment.

Complaints have been made that a dull blade takes too much power for a man's hands to make it cut. For this reason a "mechanic's dog" was adjusted¹⁵ to the original model, leaving the model in every way unchanged. It is applied for the last cutting only.

In bearing in mind the importance of the final down turn of the shaft regardless of what may be its outward inclination, much of the difficulty of the technic vanishes. There remains, however, a part played by the sense of touch. This is a small one in the usual case, and its importance may escape the surgeon's attention. It becomes, however, a large part as soon as he meets the peritonsillar infiltrate left in the wake of the various inflammatory throats. Then it is that he must attend carefully to what is under his finger tip. Peritonsillar infiltrates are difficult to recognize before the operation, and may be of any thickness up to 2 cm. and of any consistency up to cartilage. Many times I have successfully managed one of 2 cm. thickness. The management of peritonsillar infiltrates is a matter of experience after the technic is satisfactory for uncomplicated cases.

The original description of the "operative procedure"¹⁰ is in every detail correct and complete. None of it has been changed or omitted.

It is not a matter of force, as some surgeons think. Beginners are apt to employ too much force.

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ABSTRACT OF DISCUSSION

DR. G. HUDSON-MAKUEN, Philadelphia: The Sluder method is now more talked about, and deservedly so, than any other method or perhaps than all other methods combined. I was among the first to recognize the value of the procedure and to make practical application of it. Dr. Sluder's revised explanation of the technic leaves nothing to be desired. Many

15. Sluder, Greenfield: A Method of Tonsillectomy by Means of the Alveolar Eminence of the Mandible, *THE JOURNAL A. M. A.*, March, 1913, p. 650.

modifications of the instrument have been devised, the chief purpose for which has been the final enucleation of the tonsil after it has once been dislocated from its bed and grasped within the fenestra of the instrument. No one as far as I know has improved on Dr. Sluder's original method of dislocation, which, after all, is the distinguishing feature of the operation. My first and only difficulty with the method, however, was not that it was hard to dislocate the tonsil from its bed and engage it in the instrument but rather that with the comparatively sharp blade of the original instrument and a rapid driving of it through I always had a considerable amount of bleeding, to check which required several minutes of time and occasionally a ligature or two. On account of this excessive bleeding, I concluded that the blade should not be sharp and that it should not be driven home rapidly. Therefore I dulled the blade a little, after which I seemed not to have strength enough in my hand to drive it through slowly and at the same time completely. I tried a snare placed between the instrument and the pharyngeal wall, using the Sluder instrument merely in the place of a forceps for engaging the tonsil, but the snare bruised and in other respects injured the tonsillar pillars, and then I tried placing the snare on the other or inner side of the instrument, which plan I have been using with great satisfaction for the last five years. My modification of the operation has none of the disadvantages of the various other modifications; indeed, its only disadvantages should be regarded as minor ones. For example, it requires two additional instruments, a snare and a pair of forceps to hold the tonsil after it has been squeezed out of its bed by the wire, and it is also a little more difficult of performance and it requires a little more time. Its advantages, on the other hand, may be summed up in the expression "safety first," and this I think must overshadow all possible disadvantages in any operation on any part of the body. When the tonsil is once grasped within the fenestra of the original Sluder instrument it is completely isolated from the surrounding structures, and the wire of the snare hugs it so closely that the gland is squeezed out of its bed together with its very thin capsule, and the only cutting accomplished by it is that of the mucous membrane reflected from the pharyngeal wall over the median surface of the gland. When properly performed, therefore, there can be no injury to the soft parts of the pharynx, and there should be in uncomplicated cases practically no bleeding. Dr. Sluder referred to my claim that this procedure splits the capsule of the tonsil. I think it serves to split not the true capsule but that which is frequently regarded as being the true capsule. In other words, it separates the tonsil with its true capsule from the intrapharyngeal aponeurosis to which the tonsil and its true capsule are closely attached.

DR. GEORGE PAULL MARQUIS, Chicago: The important point in an operation is to select one which will do the work. This operation is a difficult one. I can readily understand that to one who has not tried it it looks easy to stand beside an operator doing the Sluder. He sees the guillotine go into the mouth, the finger follows, there is a movement of the thumb, and in two or three seconds out comes the tonsil. Now these two or three seconds are nothing compared to the time required for a dissection; there is no argument on that proposition at all; nobody can dissect a tonsil so quickly as that. But I have seen men try to do that operation and have seen them mutilate throats. Dr. Sluder says that the technic of the operation is the education of the finger. Educate the finger to replace the eye. Now that is all very well. As I said, I am talking about your doing it, not about him doing it. Please do not confuse that. You do this operation and then wait four or five days or a week and then do another—do you think that will educate the finger so that it will replace the eye? Do you think you will be able to tell by the feeling in there just what you have under the finger at any moment? I would rather trust my eye. I have not been able to train my finger so it will replace my eye, and I do not see how anybody can unless they are doing the work all the time. How are we to decide whether we will do the Sluder or the dissection method? Which method will give the best results? Which will cause the least injury to the tissues? Which can be done in the shortest space of time? If any man can do the Sluder operation and have his work 99.6 per cent. perfect, I have not a word to say. I cannot do it. I can work 99.6 per cent. clean with the dissection method. Some of you may train the finger so that you will not catch the anterior pillar or the posterior pillar, but simply split the capsule and get it out very nicely. I cannot do it. I have wounded the anterior and the posterior pillars. If you take it by the dissection method, simply catching the tonsil and holding it out where it is firm, then all you have to do is to slip the point of the knife under the plica and continue the curve all around, separating the posterior as well as the anterior pillar from the tonsil. It can be done in a couple of seconds. Then by merely turning down the handles of the forceps you can slip the snare over them without releasing them. The great objection to the dissection method is that if you let go of the tonsil after having grasped it you never can catch it in exactly the same way, whereas, if you slip the snare around without loosening the forceps you have the same position, and same view of the free tonsil. My assistant is standing there with a sponge and when the snare is drawn through, the sponge slips in and replaces the tonsil. Preventive medicine is much more efficient than curative medicine. If you don't allow it to bleed you don't have to stop a hemorrhage. You simply replace the tonsil with the sponge and hold it there for a

minute; after that is done the pillar is retracted and an iodine solution applied to the fossa. You have not much if any hemorrhage, and I do have a lot of hemorrhage with the Sluder method.

DR. W. E. DIXON, Oklahoma City: I want to second everything Dr. Sluder said about his operation, or rather his technic, but I use the LaForce instrument which crushes the blood vessels and absolutely prevents bleeding. I have made the same mistake as Dr. Sluder, in that I told men that any one could take tonsils out easily and quickly by this technic. Many of them mutilated the tonsils and pillars and failed to get them out. It certainly is a mistake to use too much pressure against the tonsil and pillars, as it will only tend to bruise the pillars and is not necessary. Dr. Sluder says to bring the tonsil upward and forward. This can be done without force and with very little pressure. Then bring down the dull blade of the instrument, and the tonsil is clamped off. Take plenty of time before the cutting blade is screwed home, and there will be practically no hemorrhage. Again with this instrument, I do not think as much mucous membrane is cut off as with a sharp instrument. Why? Because when you clamp the tonsil off, if you see you have too much mucous membrane, you can take it off and pull the tonsil up so that you have nothing but the tonsil. If too much mucous membrane is removed with the tonsil, so that any portion of the edge of the pillars are denuded, contraction of the tissue is bound to follow, whereas, if the mucous membrane is cut close to the tonsil, there will be no contraction and in 90 to 95 per cent. of all cases it will be difficult to tell that an instrument has been used in the throat any time after healing has taken place.

DR. E. R. LEWIS, Dubuque, Ia.: I have here an instrument for bloodlessly removing tonsils after a scheme of Makuen and Lynch—the double snare method. Two wire loops are carried around the tonsil in the ring of the fenestrated snare-cannula. The distal loop, the one used for enucleating the tonsil, is tightened first, down to about one-half way toward complete separation of the tonsil capsule from its aponeurotic bed, and in that position it is locked by the lock lever. Sufficient tension can now be exerted to pull the tonsil away from the mandible upward and backward toward the midline, so that the intrapharyngeal aponeurosis is lifted into a sort of pedicle, around which pedicle the second (proximal) wire loop is tightened, sufficiently to insure its holding its grasp after the tension on the instrument (upward and backward) has been released. As long as this second wire loop holds the tissues underlying the tonsil firmly in its grasp it constitutes a tourniquet, absolutely preventing any bleeding. The first (distal) loop is now slowly drawn home into the cannula, completing the separation of the capsule from the aponeurosis. The aponeurosis remains puckered in the firm grasp of the

second (proximal) wire loop, which completely controls bleeding from all vessels which are severed by the cutting wire loop. This procedure permits removing the tonsil in its capsule, with a minimum of traumatism to the pillars and fauces, without losing one drop of blood.

DR. W. W. CARTER, New York: I have had an experience of upward of 2,000 cases by the Sluder method. I use the original instrument. I do not believe it can be improved on. In my service at Gouverneur Hospital we have operated on small children at the rate of thirty-four cases per hour, and that without trying to break any record. Four anesthetists are used and many of the cases are done under primary anesthesia. I asked my house surgeon recently at what rate we were operating, and he said that we had done 17 tonsillectomies in thirty minutes. In all of my cases we have not had any bad results and the tonsils have been enucleated. The only unsatisfactory results have been in adult cases which have been suffering for a number of years from peritonsillar inflammation. You will recall that the capsule of the tonsil is composed of four or five thin layers of tissue which in the young slide over each other very easily. In adult cases where the tonsils have been subjected to repeated attacks of inflammation these layers are agglutinated and the capsule is firmly united to the surrounding muscular structures. Such cases I believe are unsuited to the Sluder method. Such tonsils, after carefully dissecting them away from the pillars, should be removed by the snare.

DR. FRANK E. AUTEN, Belleville, Ill.: I do not use Dr. Sluder's instrument but I appreciate its worth. From 1904 to 1910 I spoke before this body on tonsillectomy versus tonsilotomy. In 1901 Dr. Tydings of Chicago did the first tonsillectomy as a distinctive operative procedure and established the operation for all time. He used a blunt hook and a snare; he afterward substituted his curved knife and snare. I immediately took up the operation in 1902 and have been using it ever since. Dr. Sluder's splendid technic and most magnificent instrument is all right in the hands of men who know how to use it. There is one kind of tonsil that in my judgment you can remove only in one way, and that is in the old peritonsillar cases where the capsule and the muscle are one. In these cases the dissection method and the snare are the best. This technic will remove any tonsil. In the past fourteen years I have taken out many tonsils by this method. While in London I saw a surgeon working who had removed over 4,000 pairs of tonsils with a simple artery forceps, with beautiful results. Many men are operating with many different technics and yet all are getting fine results. That technic which best fits the man is the one for the individual surgeon to use. It gives me great pleasure to see the almost universal adoption of tonsillectomy as a surgical procedure in the removal of the tonsils. It has done more for the children

of the world and many adults than any single operation in surgery. In India and other parts of the world they are doing tonsillectomies. Dr. Edwin Pynchon taught us that a small submerged tonsil was most often a dangerous tonsil; that it was a question of infection rather than the size that should determine the removal of the tonsil. Which idea fixed for all time the necessity for complete removal of all diseased tissue, for if the drainage of infectious material into the system was to be stopped it must be done by a clean removal of all of the diseased tonsil.

DR. J. F. BARNHILL, Indianapolis: Three years ago I condemned the Sluder method. I did not know how to do it. I now use the Sluder instrument, the latest one, and follow Sluder's method as nearly as possible, and I believe that my tonsil work is now better than it ever was by the dissection plan. Nearly all tonsils can be removed by this method of procedure. I have tried it over and over again in peritonsillar abscess cases, and it has seemed to me that the success has been nearly the same in these cases as in the cases in which there was only simple inflammatory hypertrophy. I have also employed the Sluder method under local anesthesia. Formerly I did these operations under local anesthesia with a snare. I wondered if they might not be done just as easily with the Sluder, and I found that such was the case; the patients complain of no pain, the operation is quickly done, and there is as little bleeding as by any other method of which I know. The final result is quite satisfactory, and I am sure that those who try it with a local anesthetic will find it very satisfactory. I have wondered as to whether in certain cases, where there is already some involvement of the cervical glands, if the necessary amount of pressure on the tonsil by the Sluder method in lifting it up might cause some recurrence of an infection that already existed prior to this operation. I have seen a few cases in which I believe that such had been the case. It is my present belief that the Sluder method offers all of the good points offered by any other method, can be carried out in less time, and gives better end-results.

DR. H. W. LOEB, St. Louis: I was very much interested in the remarks of some of the speakers as to the difficulty of learning the Sluder technic. I had difficulties in the beginning, but I had also to learn to dissect the first tonsil right. I want to refer for a moment to a method that is being used by many of Dr. Sluder's followers, including myself, who have not the strength that he has in the thumb, and that is stripping the tonsil. After the tonsil is pushed through the ring it is then turned down toward the larynx and with the finger the tonsil is stripped away from the palate. That has been a most satisfactory procedure in connection with the Sluder method.

DR. WILLIAM S. TOMLIN, Indianapolis: The specimens Dr. Sluder presented to us at St. Louis six years ago compare very favorably with those he shows us today, evidencing that he was doing the operation as well then as he does it now. I am also very glad to hear him say that he considers the operation a very delicate and difficult one as I felt for a long time that I certainly must be very clumsy, for I am free to say that it took me at least two years to feel thoroughly sure of removing each and every tonsil at the first attempt. One point I want to make especially, and it was just mentioned by Dr. Loeb, is the "stripping of the tonsil." That I consider a very important part of the operation for two or three reasons. In the first place, it does away with the necessity of using any dog or other mechanical device for finally removing the tonsil from its moorings. In the second place, if it is done properly with good technic it will accomplish the same purpose as is being attempted by Dr. Makuen in the attachment of the snare. If the tonsil be drawn well up out of the bed, the knife just sufficiently forced against the anterior pillar at its conjunction with the capsule, stretching the peritonsillar tissue, coincidentally sliding the knife home you get a clean capsule and leave the round of the pillars intact with the one combined movement. Another thing about the peritonsillar abscesses: I have seen cases where there was an extraordinary rise in temperature when there had been peritonsillar pus. When this is the case I take a sharp knife and see that drainage is made through the supratonsillar tissue for its discharge. This will often obviate postoperative rise of temperature.

DR. CULLEN F. WELTY, San Francisco: I have not used Dr. Sluder's method because I have been satisfied with what I have been doing. I wish to say again for the Sluder method or any other method, that I do not believe it will serve well where the tonsils have been operated on before. Others have had peritonsillar abscess! These are the ones that come to me, and some cannot be operated by any procedure that depends on dislocating the tonsil into the ring of the instrument. Rather than complicate my instrumentarium I have decided on the method that is known as the procedure of Markham of Chicago, and I have no reason to change it yet.

DR. E. E. HENDERSON, Chicago: I first saw Dr. Sluder demonstrate this instrument six years ago. Since that time I have been using it. There were a few failures at first due to faulty technic where we had submerged or peritonsillar adhesions to deal with. Now that we understand Dr. Sluder's method better and have developed the sense of touch, we very seldom encounter a failure in the removal of any type of tonsil. The rapidity and remarkable dexterity one can acquire by using the Sluder instrument is wonderful. Another great advantage obtained by the use of this instrument is in gas

analgesia, using the dental type of inhaler, requiring only the minimum of time for the operation, thereby lessening the shock to the patient, also avoiding aspiration of septic material into the lungs. Again we are very much in favor of a fairly sharp blade, as a clean cut with a sharp instrument diminishes the amount of trauma and, in our experience, lessens the hemorrhage.

DR. OLIVER TYDINGS, Chicago: I started the dissection work on the tonsil on account of operating on my wife with the cautery. Pynchon taught me the use of the cautery, but I thought there should be a better method, so I worked out the dissection. At first I was very much alarmed on account of the fear of hemorrhage, but since I became more familiar with the operation I do not fear that so much, and I think in the doing of any kind of work our patient is entitled to the best skill of the operator. There is a certain proportion of tonsils which can be taken out by almost any method, but I deny that any man lives who can take out as many tonsils, day after day, by any other method than careful dissection, without doing injury, particularly when they are rushing them through at the rate of thirty-four an hour. When you take into consideration that that means less than two minutes for doing this work, a work requiring a great deal of skill—I tell you that the superficial examination cannot be as perfect as it would be if you are doing careful work. Whenever you are rushing them through at that rate, somebody must do careless work. Today I use the same practice and same methods I did in 1904, with one exception—infiltrating around the tonsil. I do not think I have changed my technic at all, but I have changed from a blunt to a sharp instrument in hugging the tonsil. I believe that a great many tonsils can be removed with Dr. Sluder's method as effectively as with any other, provided you will follow the technic of Dr. Sluder; but I know that I can remove that same tonsil, perhaps not as quickly, but I can take it as free from tonsillar attachment, by following the dissection method. If you have adhesions to pillar you cannot separate it by any method except by leaving an exposed pillar more or less. But that is not the cause of deformity. The cause of deformity is reckless cutting into your pillar; there is where you get deformity. If you separate it carefully you will not have deformities to amount to anything.

DR. W. W. CARTER: Dr. Tydings intimated that the operation could not be done as rapidly and effectively as I mentioned. All the cases operated on in my clinic are examined beforehand; then they are brought back to the hospital for examination one week after the operation. The results have been very satisfactory and we have had no cases of alarming hemorrhage.

DR. OLIVER TYDINGS: I apologize to Dr. Carter. I did not intend to cast any reflection on his veracity, but I venture to say that there is not one operator in a thousand who will accumulate such a speed with as fine a technic in the course of a lifetime. I congratulate the doctor on his efficiency in that line. I know he is particularly expert along more lines than that, and I am glad to pay my tribute to the man who can do these things.

DR. GREENFIELD SLUDER, St. Louis: I did not mean to anticipate this entire discussion when I said that the surgeon should adhere to that particular technic that he is best capable of doing. I followed that with the statement that for those not satisfied with old methods, or the man in his developmental years who must learn some new technic, this is certainly a good one. The question of hemorrhage was spoken of, and Dr. Makuen suggests controlling it by the snare. I think the anesthetic has a great deal to do with this. If you do this under profound anesthesia, the bleeding will be very small. If you do it under gas, fill the patient full of a good big meal a few minutes before, and he does not lose his nourishment and he stands three times the amount of strain with the same degree of shock as under ether or any other anesthetic, but the blood pressure is raised and a small immediate bleeding follows. Secondary hemorrhage is rare. I believe that in the whole profession, old and young, there are a good many who will never succeed with this. I think also that there are others who will never succeed with any other method. For him who is satisfied with what he has, let him adhere to it; for him who is not, this may have advantages as enumerated.

Various points have been brought about the bloodless method. We have not had the success that Dr. Lewis has had—that all have been bloodless. They have all bled, and we adhere to the original guillotine, not only because of its advantages but because of its lack of disadvantages. I cannot emphasize too much the importance of the sense of touch. It is a great advantage when you can feel what you are doing, when oftentimes you cannot possibly see.

LIST OF FELLOWS OF THE AMERICAN MEDICAL ASSOCIATION REGISTERED IN THE SEC- TION ON LARYNGOLOGY, OTOTOLOGY AND RHINOLOGY

List of Fellows of the American Medical Association who registered in this Section at one or more of the last five Annual Sessions, together with Fellows who have subscribed to the Transactions of the Section for 1916. The figures following the names indicate the attendance at the Annual Sessions (6 indicates 1916, 5 indicates 1915, etc.). T follows names of nonattendant Fellows subscribing to the Transactions for 1916.

Corrections will be appreciated.

ALABAMA

Huey, Thos F., Anniston, 0, 2.
Kirkpatrick, Samuel, Selma, 4.
Ledbetter, S. L., 1st Natl. Bk. Bldg.,
Birmingham, T.
Mertins, Paul S., 18 S. Perry St.,
Montgomery, 4.
Rucker, E. W., Jr., Woodward
Bldg., Birmingham, 4.
Searcy, Harvey B., Alston Bldg.,
Tuscaloosa, T.
Sibley, B. D., 2150 Highland Ave.,
Birmingham, T.
Thigpen, C. A., 13 S. Perry St.,
Montgomery, T.
Thigpen, F. M., 1st Nat. Bank
Bldg., Montgomery, 9, 2.

ARIZONA

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McLoone, John J., Phoenix, 5, 6.

ARKANSAS

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Little Rock, T.
Huntington, Robert H., 6th and
Spring Sts., Eureka Springs, 6.

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Bacher, J. A., Garden City Bk.
Bldg., San Jose, 5.
Bell, George, Fair Oaks, 5.
Bixby, E. M., Shreve Bldg., San
Francisco, T.
Black, J. A., Hotel Fairmount, San
Francisco, T.
Briggs, Wm. E., 1005 K St., Sacra-
mento, T.
Brinckerhoff, G. E., Delger Bldg.,
Oakland, 5.
Brooks, Clifford H., Spurgeon
Bldg., Santa Ana, 5.

Brown, J. MacKenzie, Brockman
Bldg., Los Angeles, 1, 5.
Burton, F. A., Watts Bldg., San
Diego, 5.
Cameron, Howard M., Elks Bldg.,
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St., San Francisco, 5.
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rovia, 1, 5.
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Francisco, T.
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Angeles, T.
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Francisco, 3.
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San Francisco, 5.
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Hart, Morton E., 246 Powell St.,
San Francisco, 5.
Hastings, Hill, Trust and Sav.
Bldg., Los Angeles, 1, 5, 6.
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mento, 5.
Horn, Henry, 209 Post St., San
Francisco, 0, 1, 4, 5.
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San Francisco, 5.
Johnson, Abel W., 350 Post St.,
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Jones, P. M., Butler Bldg., San
Francisco, T.

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 Kiefer, Hugo A., Brockman Bldg., Los Angeles, 5.
 Kress, G. H., Bradbury Bldg., Los Angeles, 1, 6.
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 McNaught, Harvard Y., Butler Bldg., San Francisco, 1, 5, 6.
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 Rhodes, John Edwin, Peoples Gas Bldg., Chicago, T.
 Robertson, Charles M., 30 N. Mich. Ave., Chicago, 6, 8, 9, 2, 6.
 Shambaugh, George E., 5625 University Ave., Chicago, 6, 7, 8, 9, 0, 2, 3, 4, 6.
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 Torrison, George A., 2338 N. Kedzie Blvd., Chicago, 6, 8, 0, 3.
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 Williams, Wright C., 201 Rebecca St., Peoria, T.

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 Hill, H. B., 415 Fourth St., Logansport, 6.
 Keiper, George F., 14 N. 6th St., Lafayette, 6.
 Kelsey, T. W., Cent. Bk. Bldg., Attica, 3.
 Layman, Daniel W., 608 Hume Mansur Bldg., Indianapolis, 7, 8, 9, 0, 3, 6.
 McBride, W. O., Gauntt Bldg., Ft. Wayne, T.
 McCaskey, Carl H., Am. Central Life Bldg., Indianapolis, 5, 6.
 Mendenhall, F. F., Elwood, 5.
 Molt, William F., Newton Claypool Bldg., Indianapolis, T.
 Pfaffin, Chas. A., Newton Claypool Bldg., Indianapolis, T.
 Smith, G. H., Union Bldg., New Castle, 1, 6.
 Spohn, Geo. W., Elkhart, 3, 6.
 Stewart, Charles S., Auburn, 8, 2.
 Tomlin, W. S., 1820 N. Illinois St., Indianapolis, 9, 0, 4, 6.
 Wales, Ernest deWolfe, Hume Mansur Bldg., Indianapolis, T.
 Wheelock, K. K., 1020 S. Harrison St., Ft. Wayne, T.
 Zaring, E. T., 13th St. & 8th Ave., Terre Haute, 6.

IOWA

Boiler, Wm. F., Iowa Citv. T.
 Bussey, William J., Security Bldg., Sioux City, 3.
 Childs, R. F., Audubon, 6.
 Dean, Lee Wallace, Iowa City, 0, 2, 3, 4, 6.
 Downing, J. A., Equitable Bldg., Des Moines, T.
 Elmer, A. W., 730 E. Locust St., Davenport, T.
 Engle, Harry P., Newton, 3.
 Franchere, Frederick E., 614 F. L. & T. Bldg., Sioux City, 5.
 Frantz, Chas. F., Iowa State Bank Bldg., Burlington, T.
 Harkness, G. F., 3d and Brady Sts., Davenport, 6.
 Henninger, L. L., 525 Bluff St., Council Bluffs, 3, 4.
 Howland, Chas. F., Franklin Bldg., Des Moines, 4.
 Johnston, Wm. H., Hershey Bldg., Muscatine, 3, 6.

LaForce, E. Frank, Iowa State Savings Bank Bldg., Burlington, 8, 2, 4.
 Langworthy, H. G., 10th and Bluff Sts., Dubuque, 6.
 Lewis, E. R., Dubuque, 7, 9, 0, 2, 3, 6.
 Matthews, Robert J., Clarinda, 6.
 Naftzger, J. B., Davidson Bldg., Sioux City, 6.
 Owen, W. E., 1st Ave. and 3d St., Cedar Rapids, 3.
 Pagelsen, O. H., Iowa Falls, T.
 Parker, Ralph H., Fleming Bldg., Des Moines, T.
 Pearson, W. W., Equitable Bldg., Des Moines, T.
 Reeder, James E., Davidson Bldg., Sioux City, T.
 Roost, Fredk. H., Box 341, Sioux City, 3.
 Sage, Fred C., 1st Nat. Bk. Bldg., Waterloo, 3.
 Shore, F. E. V., Citizens Bk Bldg., Des Moines, 7, 8, 1, 3.
 Walters, B. Frank, Security Bank Bldg., Sioux City, T.
 Weih, E. P., Wilson Bldg., Clinton, T.
 Werts, C. M., Equitable Bldg., Des Moines, 4.

KANSAS

Alkire, H. L., 614 Kansas Ave., Topeka, T.
 Cole, Chas. W., Norton, T.
 Dorsey, J. G., 105 W. Douglas Ave., Wichita, T.
 Esterly, D. E., 813 Kansas Ave., Topeka, T.
 Graves, W. H., Commerce Bldg., Pittsburg, T.
 Litsinger, George H., Topeka, 6.
 Sawtell, Jos. E., Walheim Bldg., Kansas City, 4, 6.
 Zugg, C. L., Arkansas City, T.

KENTUCKY

Brown, F. M., Hopkinsville, T.
 Caldwell, J. A., Electric & Shaler Ave., Southgate Newport, 6.
 Coleman, J. S., Main St., Frankfort, T.
 Griffith, D. M., 207 W. 4th St., Owensboro, T.
 Grubbs, S. B., U. S. Marine Hosp., Louisville, T.
 Hall, Gaylord C., 1113 S. Brook St., Louisville, T.
 Lawrence, N. L., 409 Fountain Ct., Louisville, Ky.
 Lockhart, Robert, 315 Allen St., Owensboro, 6.
 Peabody, J. R., The Atherton, Louisville, T.
 Pfingst, Adolph O., Atherton Bldg., Louisville, 6, 7, 9, 3.
 Purcell, C. E., Fraternity Bldg., Paducah, T.
 Ray, J. M., Atherton Bldg., Louisville, T.
 Reynolds, H. G., R. City Natl. Bk. Bldg., Paducah, T.

Stucky, Joseph A., Fayette Nat. Bank Bldg., Lexington, 7, 8, 9, 0, 2, 3.
 Stucky, William S., Lexington, 6.
 Wolfe, Claude T., Atherton Bldg., Louisville, T.

LOUISIANA

Dowling, Oscar, Commercial Natl. Bank Bldg., Shreveport, T.
 Dupuy, Homer, Medical Bldg., New Orleans, 2.
 Joachim, Otto, Macheca Bldg., New Orleans, 4.
 Landfried, Chas. J., 5907 Garfield St., New Orleans, T.
 Lynch, Robt. C., 624 Gravier St., New Orleans, 4, 6.
 Weil, Arthur I., Perrine Bldg., New Orleans, 4.

MAINE

Allen, John H., 717 Congress St., Portland, T.
 Gribbin, H. E., 9 Claremont St., Rockland, T.
 Hill, J. F., 111 Main St., Waterville, T.
 Holt, E. E., 723 Congress St., Portland, T.
 Smith, Owen, 692 Congress St., Portland, 4.
 Turner, Oliver W., Water St., Augusta, T.
 Wakefield, F. S., 342 Main St., Lewiston, T.

MARYLAND

Caspari, William, 1603 Madison Ave., Baltimore, 2, 4.
 Cohen, Lee, 1820 Eutaw Pl., Baltimore, T.
 Downey, Jesse W., Jr., 529 N. Charles St., Baltimore, 4.
 Flechenstein, H. K., 700 N. Howard St., Baltimore, T.
 Friedenwald, Harry, 1029 Madison Ave., Baltimore, T.
 Harlan, Herbert, 516 Cathedral St., Baltimore, T.
 Jones, E. L., 1st Natl. Bk. Bldg., Cumberland, 7, 8, 9, 4.
 Keller, L. H., 229 W. Washington St., Hagerstown, 9, 2, 4.
 Mitchell, George W., 11 E. Chase St., Baltimore, 7, 1, 2, 4, 6.
 Peterman, H. E., 114 W. Franklin St., Baltimore, T.
 Reik, Henry Otridge, 506 Cathedral St., Baltimore, 6, 7, 8, 9, 2, 5.
 Reik, J. N., 506 Cathedral St., Baltimore, 9, 0, 2, 4.
 Sanger, Frank Dyer, 535 N. Charles St., Baltimore, 7, 9, 2, 4, 6.
 Winslow, John R., The Latrobe Apt., Charles and Read Sts., Baltimore, 7, 9, 4.
 Woods, Hiram, 842 Park Ave., Baltimore, T.
 Worthington, T. C., 1022 Madison Ave., Baltimore, 9, 2.

MASSACHUSETTS

Blodgett, John H., 390 Commonwealth Ave., Boston, 6.
 Borden, Charles R. C., 520 Commonwealth Ave., Boston, 6, 9, 2, 4.
 Bryant, Alice G., 502 Beacon St., Boston, 6.
 Cahill, J. W., 390 Main St., Worcester, T.
 Corbett, J. J., 71 Summer St., Malden, T.
 Councilman, W., 78 Bay State Road, Boston, T.
 Crockett, E. A., 298 Marlboro St., Boston, T.
 Drury, Dana W., 407 Marlboro St., Boston, T.
 Eagleton, W. P., Oceanside Hotel, Magnolia, T.
 Emerson, Francis P., 520 Commonwealth Ave., Boston, 6, 0, 1, 2, 3, 4, 5, 6.
 Foster, E. E., 271 Union St., New Bedford, 2.
 French, C. E., Wymans Exchange, Lowell, T.
 Goodell, Wm., 6 Chestnut St., Springfield, 4.
 Greene, D. Crosby, Jr., 483 Beacon St., Boston, 4.
 Hammond, Philip, 483 Beacon St., Boston, T.
 Holmes, Edgar M., 531 Beacon St., Boston, 4.
 Irwin, V. J., 351 Main St., Springfield, T.
 Jack, Frederick L., 215 Beacon St., Boston, T.
 Jackson, Oliver H., 34 N. Main St., Fall River, T.
 Jessaman, Leon W., 60 Concord St., Framingham, 4, 6.
 Jones, Daniel Fiske, 195 Beacon St., Boston, 5.
 Jones, Everett, 1658 Beacon St., Brookline, 2.
 Knowles, Wm. F., 220 Clarendon St., Boston, 4, 6.
 Leahey, George A., 128 Merrimac St., Lowell, T.
 Livingston, C. B., Wymans Exchange, Lowell, T.
 Lothrop, Howard A., 101 Beacon St., Boston, 5.
 Lougee, John L., 514 Commonwealth Ave., Boston, 4.
 Lovell, David B., State Mutual Bldg., Worcester, T.
 Merrill, W. H., Bay State Bldg., Lawrence, T.
 Mosher, Harris P., 828 Beacon St., Boston, 4, 6.
 Murdock, F. W., 54 W. Elm St., Brockton, 6.
 Noyes, Margaret L., 32 St. James Ave., Boston, 6, 8, 2, 3.
 Procter, Percy C., Gloucester, 6, 7, 9, 2, 4.
 Richards, George L., 124 Franklin St., Fall River, 5, 6, 7, 9, 2, 3, 4.
 Taylor, James, Jr., 49 Pearl St., Worcester, 2.
 Thompson, Geo. H., 18 Ashland St., North Adams, 4, 6.

Walker, David H., 390 Commonwealth Ave., Boston, 4, 5, 6.
 Warner, C. T., 75 West Main St., Marlboro, T.
 Weaver, Harry V., 161 William St., New Bedford, T.
 Webster, George A., 419 Boylston St., Boston, T.
 White, Leon E., 397 Marlboro St., Boston, T.

MICHIGAN

Abbott, Alfred J., 109 S. Superior St., Albion, 6.
 Amberg, Emil, David Whitney Bldg., Detroit, 6.
 Baker, Chas. H., Crapo Block, Bay City, 6.
 Barlow, Roy A., University Hosp., Ann Arbor, 6.
 Bentley, Neil, David Whitney Bldg., Detroit, 6.
 Bernstein, Edward J., 523 W. Main St., Kalamazoo, 6.
 Bird, Wm. G., Flint P. Smith Bldg., Flint, 3, 6.
 Brown, Frank W., Crapo Bldg., Bay City, 6.
 Bulson, A. E., Sun Bldg., Jackson, T.
 Bulson, Glenn A., 30 W. Adams Ave., Detroit, 6.
 Burdick, Austin F., Jenison Block, Lansing, 6.
 Camelon, T. P., David Whitney Bldg., Detroit, 6.
 Canfield, R. Bishop, 300 State St., Ann Arbor, 6, 8, 0, 2, 3, 6.
 Casey, James E., 218 Porter St., Detroit, 6.
 Colver, Benton N., 315 Champion St., Battle Creek, 3, 6.
 Connor, Ray, Washington Arcade, Detroit, T.
 Cushman, M. L., Tussing Bldg., Lansing, 0, 2, 6.
 Defnet, W. A., 32 Adams Ave., Detroit, 6.
 Ellis, C. W., Tussing Bldg., Lansing, 6.
 Elwood, C. R., Spiers Bldg., Menominee, 6.
 Fulkerson, C. B., Kalamazoo Natl. Bk. Bldg., Kalamazoo, 6.
 Gillman, Robert W., 33 Peterboro St., Detroit, T.
 Gleason, J. E., David Whitney Bldg., Detroit, 6.
 Goux, Louis J., David Whitney Bldg., Detroit, 6.
 Hartz, Henry J., David Whitney Bldg., Detroit, 6.
 Haughey, Wilfrid, 303 Post Bldg., Battle Creek, 6.
 Hickey, Preston M., 32 Adams Ave., W. Detroit, 2, 3, 4, 6.
 Holdsworth, Frank, 727 S. Union St., Traverse City, 6.
 Huizinga, J. G., Widdicomb Bldg., Grand Rapids, T.
 James, R. G., David Whitney Bldg., Detroit, 6.
 Leenhouts, Abraham, 284 Maple St., Holland, 6.

McClelland, Carl C., David Whitney Bldg., Detroit, 6.
 McFall, Guy H., David Whitney Bldg., Detroit, 6.
 Mercer, R. E., 126 Monterey Ave., Detroit, 9, 3, 6.
 Merrill, William O., D. Whitney Bldg., Detroit, 6.
 Miner, Stanley G., 58 Cadillac Sq., Detroit, 6.
 Moffett, John J., 1512, 10th St., Port Huron, 6.
 Monford, Willard, Fine Arts Bldg., Detroit, 6.
 Morden, Esli T., Lenowee Co. Sav. Bk. Bldg., Adrian, 6.
 Newark, W. E., 121 Seminary, Charlotte, 6.
 Odell, Anna, Kresge Bldg., Detroit, 0, 2, 4, 6.
 O'Donovan, Daniel, 11 Baker St., Detroit, 6.
 Orr, J. W., Smith Bldg., Flint, 6.
 Owen, Arthur E., 128 W. Allegan St., Lansing, 6.
 Peirce, Howard W., 1225 VanDyke Ave., Detroit, 6.
 Potter, Willis A., D. Whitney Bldg., Detroit, 6.
 Renaud, George L., 30 Adams Ave., W., Detroit, 6.
 Rogers, A. S., 115 S. Jefferson Ave., Saginaw, 6.
 Shaw, Robert G., 291 Pennsylvania Ave., Detroit, 6.
 Shurly, Burt Russell, 32 Adams Ave., W., Detroit, 7, 8, 9, 0, 1, 2, 3, 4, 6.
 Simpson, H. L., D. Whitney Bldg., Detroit, 6.
 Slocum, George, 311 S. State St., Ann Arbor, 6.
 Smith, Eugene, 34 W. Adams St., Detroit, 6.
 Smith, Ferris N., Metz Bldg., Grand Rapids, 6.
 Spicer, Walter E., 15 Dwight Blk., Jackson, 6.
 Sumner, Benson R., 184 Ferry Ave., Detroit, 6.
 Tolley, E. W., 16-18 Monroe Ave., Grand Rapids, 6.
 Warren, Wadsworth, 612 Washington Arcade, Detroit, 6.
 Welsh, D. E., Powers Block, Grand Rapids, 6.
 Wendel, Jacob S., 1118 E. Ann St., Ann Arbor, 6.
 White, John V., D. Whitney Bldg., Detroit, 6.
 Wilson, Harold, D. Whitney Bldg., Detroit, 4, 6.
 Winter, G. E., Sun Bldg., Jackson, T.

MINNESOTA

Beaudoux, Henry A., Lowry Arcade, St. Paul, 3.
 Benham, E. W., Box 55, Mankato, 3.
 Bettingen, J. W., Lowry Bldg., St. Paul, 3.
 Bishop, C. Wesley, Pillsbury Bldg., Minneapolis, T.
 Blake, Jas., Hopkins, 3.

Böckman, Michael W., Pillsbury Bldg., Minneapolis, 3.
 Boeckmann, Egil, Lowry Bldg., St. Paul, 3.
 Boyd, L. M., Alexandria, T.
 Bray, E. R., 237 Arundel St., St. Paul, 5.
 Brown, Edw. J., 3027 Pleasant Ave., Minneapolis, 3.
 Burch, Frank E., 754 Linwood Pl., St. Paul, T.
 Campbell, Robt., A., Donaldson Bldg., Minneapolis, 3.
 Clark, Howard S., Syndicate Bldg., Minneapolis, T.
 Collins, Homer, New Jersey Bldg., Duluth, 6.
 Coulter, Chas. F., Wadena, 3.
 Davison, P. C., Wilmar, 3.
 Erickson, J. G., Syndicate Bldg., Minneapolis, T.
 Field, Merton, St. Peter, 3.
 Fisher, Carl, Y. M. C. A. Bldg., Rochester, T.
 Groves, A. F., Brainerd, 3.
 Hilger, Andrew W., Lowry Bldg., St. Paul, 3.
 Hunt, H. E., Lowry Bldg., St. Paul, 3.
 James, J. H., Mankato, T.
 Kerrick, S. E., Syndicate Bldg., Minneapolis, T.
 Kirmse, Geo. W., Pillsbury Bldg., Minneapolis, 6.
 Kohler, Geo. A., Pillsbury Bldg., Minneapolis, 3.
 Larsen, C. L., Lowry Bldg., St. Paul, T.
 Lee, John W., Syndicate Bldg., Minneapolis, T.
 Leicht, Oswald, Slade Blk., cor 3d and Main, Winona, T.
 Lewis, Jos. D., 312 Reid Corners, Minneapolis, 3.
 Lewis, W. W., Lowry Bldg., St. Paul, T.
 Matthews, Justus, Rochester, 0, 2, 3, 5.
 McDavitt, Thomas, The Lowry Bldg., St. Paul, T.
 Morley, G. A., Crookston, 6.
 Murray, W. R., Syndicate Block, Minneapolis, 8, 0, 1, 3, 4, 5, 6.
 New, Gordon B., 123 Main St., Rochester, 6.
 Newhart, Horace, Donaldson Bldg., Minneapolis, 9, 0, 3, 5, 6.
 Nordin, C. G., Brainerd, T.
 Parker, E. H., Nicollet Ave. and 7th St., Minneapolis, 3, 6.
 Plonske, Chas. J., Masonic Temple, Minneapolis, 3.
 Pratt, F. J., 328 E. Hennepin Ave., Minneapolis, 1, 2, 3, 4, 5, 6.
 Randolph, Wilson, Crookston, 6.
 Schefcik, J. Francis, Masonic Temple, Minneapolis, T.
 Smith, M. W., Red Wing, 3.
 Stemsrud, A. A., Dawson, 3.
 Strathern, F. P., 208 Nassau St., St. Peter, 3.
 Strout, E. S., 2838 James Ave. S., Minneapolis, T.
 Taylor, H. L., Lowry Arcade, St. Paul, 3.

Tilderquist, D. L., 7. E. Superior St., Duluth, 3.
 Todd, Frank C., Donaldson Bldg., Minneapolis, 5.
 Turnbull, F. M., Providence Bldg., Duluth, 6.
 Van Slyke, Charles A., Lowry Bldg., St. Paul, T.
 Watson, Jas. A., 500 Phys. & Surg. Bldg., Minneapolis, 3, 6.
 White, J. S., Lowry Bldg., St. Paul, 3.
 Wilcox, A. E., Donaldson Bldg., Minneapolis, T.
 Winter, John A., Fidelity Bldg., Duluth, 3, 6.

MISSOURI

Barck, C., Humboldt Bldg., St. Louis, T.
 Bryan, Wm. M. C., Humboldt Bldg., St. Louis, T.
 Creveling, H. Clay, Metropolitan Bldg., St. Louis, 8, 0, 4.
 Goldstein, Max A., 3858 Westminster Pl., St. Louis, 2.
 Goaney, C. W., 703 Lathrop St., Kansas City, T.
 Gundelach, C. A., Lister Bldg., St. Louis, 3, 5, 6.
 Jennings, J. Ellis, Carleton Bldg., St. Louis, T.
 Lea, J. Addison, Realto Bldg., Kansas City, 6.
 Leavy, C. A., Metropolitan Bldg., St. Louis, 6.
 Loeb, Hanau W., 537 N. Grand Ave., St. Louis, 7, 8, 9, 0, 2, 3, 5, 6.
 Logan, James E., 1208 Wyandotte St., Kansas City, 8, 9, 0, 2.
 Love, Joseph W., Woodruff Bldg., Springfield, 6.
 McLemore, T., 101½ Cherry St., Nevada, T.
 Myra, E. Lee, 3904 Laclede Ave., St. Louis, 6.
 Parrish, E. E., Memphis, T.
 Pängsten, C. F., Metropolitan Bldg., St. Louis, 6.
 Powers, Everett, Carthage, T.
 Sauer, W. E., Humboldt Bldg., St. Louis, 7, 8, 0, 1, 2, 6.
 Sawtell, J. E., 702 Waldheim Bldg., Kansas City, 7, 8, 0, 3.
 Scholz, Roy F., Metropolitan Bldg., St. Louis, 9, 0, 3.
 Schutz, W. H., Bryant Bldg., Kansas City, T.
 Shapleigh, J. B., Humboldt Bldg., St. Louis, T.
 Shumate, D. L., 3703 Penn St., Kansas City, 0, 3.
 Sluder, Greenfield, 3542 Washington St., St. Louis, 8, 9, 0, 3, 6.
 Smith, Owen A., Robinson Bldg., Farmington, T.
 Titaworth, Guy, 111 W. 4th St., Sedalia, T.
 Tureman, Herbert, Rialto Bldg., Kansas City, 0, 4.
 Weaver, John S., 904 E. 43d St., Kansas City, T.
 Yount, W. E., Himmelberger-Harrison Bldg., Cape Girardeau, T.

MONTANA

Donovan, John A., Phoenix Bldg., Butte, T.
 Morse, A. W., 834 W. Silver St., Butte, 3, 6.
 Potter, Peter, Henneasy Bldg., Butte, 2.

NEBRASKA

Byrnes, M. Robert, Main St., Crete, 5.
 Callfas, Wm. F., Brandeis Bldg., Omaha, 3.
 Cook, S. E., Richards Blk., Lincoln, T.
 Curtis, W. L., Fairbury, 6.
 Dayton, Wm. L., Funke Bldg., Lincoln, 3.
 Dillon, I. H., Auburn, T.
 Knode, A. R., Omaha New Bank Bldg., Omaha, 6.
 Lemere, H. B., Brandeis Theatre Bldg., Omaha, T.
 Moriarty, P. C., Brandeis Bldg., Omaha, T.
 Morris, F. S., McCool Jct., 5.
 Owen, F. S., 471 Brandeis Bldg., Omaha, 1, 3.
 Potts, John B., The Lorenzen, Omaha, 3, 4, 6.
 Rubendall, Clarence, Brandeis Bldg., Omaha, T.
 Sutherland, J. L., 109½ W. 3d St., Grand Island, 3.
 Wherry, W. P., 2444 Manderson St., Omaha, 3.
 Williams, J. P., Funke Bldg., Lincoln, T.

NEW HAMPSHIRE

Fritz, E., 913 Elm St., Manchester, T.
 Kittredge, F. E., Masonic Temple, Nashua, 6, 9, 4.
 Shedd, G. H., North Conway, T.
 Shedd, J. Z., North Conway, 0, 2, 3.
 Varick, W. R., 1015 Chestnut St., Manchester, T.

NEW JERSEY

Adams, Charles F., 52 W. State St., Trenton, 3.
 Ard, Frank C., 604 Park St., Plainfield, 4.
 Barkhorn, Henry C., 182 Hunterdon St., Newark, 2.
 Bull, Edward L., 2 Madison Ave., Jersey City, T.
 Chambers, T. R., 15 Exchange Pl., Jersey City, 9, 4.
 Charlton, C. Coulter, 114 S. Illinois Ave., Atlantic City, 4.
 Corwin, T. W., Weiss Bldg., 671 Broad St., Newark, 5, 7, 9, 1, 4.
 Dias, J. Lawrence, Shubert Theater Bldg., Newark, 2.
 Eagleton, Wells P., 212 Elwood Ave., Newark, 6, 7, 1, 2, 4, 6.
 Hemsath, John, 36 Spruce St., Newark, 4.

Hill, John Augustus, 201, 8th St.,
Asbury Park, 4, 6.
Hirst, Levi B., 586 Federal St.,
Camden, 9, 2, 4.
Keefe, Stephen J., 517 N. Broad
St., Elizabeth, 2, 4.
Johnson, W. B., 170 Broadway,
Paterson, T.
Marvel, Philip, 1616 Pacific Ave.,
Atlantic City, T.
Pyle, Wallace, 612 Bergen Ave.,
Jersey City, 2.
Romine, Geo. L., Lambertville, 7, 9,
8, 4.
Scarlett, R. B., 78 N. Clinton Ave.,
Trenton, 9, 2, 4.
Schlichter, Charles H., 1024 E. Jer-
sey St., Elizabeth, T.
Sheehan, Jos. E., 108 Essex Ave.,
Orange, 2.
Upham, Helen F., 305, 3d Ave.,
Asbury Park, 4.
Van Horn, Alfred F., 514 Central
Ave., Plainfield, 4.
Wilson, Norton L., 410 Westminster
Ave., Elizabeth, 9, 2, 4.
Young, J. S., 70 Irving St., Rah-
way, 2.

NEW YORK

Abraham, Jos. H., 130 W. 58th St.,
New York, 7, 9, 2, 4.
Banta, Francis M., 215 W. 101st
St., New York, 2.
Barney, B. A., 5 Center St., Hor-
nell, 6.
Benedict, A. Judson, 204 Grand St.,
Newburgh, 2, 4.
Braislin, Wm. C., 556 Washington
Ave., Brooklyn, T.
Braun, Alfred, 616 Madison Ave.,
New York, 4.
Brown, Clayton M., 510 Delaware
Ave., Buffalo, 9, 0, 2, 3, 4, 6.
Brust, Herbert O., 720 S. Crouse
Ave., Syracuse, 4.
Bryant, W. Sohler, 19 W. 54th St.,
New York, 5, 6, 7, 8, 9, 0, 2.
Carter, W. W., 69 W. 50th St., New
York, 8, 9, 2, 4, 6.
Case, George M., 154 Main St.,
Elmira, T.
Clark, Lloyd H., 337 Monroe Ave.,
Rochester, 6.
Cocks, Gerhard Hutchison, 137 E.
54th St., New York, 2.
Cott, Chester C., 185 Oxford Ave.,
Buffalo, 6.
Cott, George F., 1001 Main St.,
Buffalo, 5, 6, 7, 8, 9, 0, 2, 4, 5, 6.
Crockett, R. L., Devereaux Blk.,
Oneida, T.
Culbert, Wm. L., 16 E. 54th St.,
New York, 2.
Curtis, H. H., 118 Madison Ave.,
New York, 4.
Davis, A. E., 50 W. 37th St., New
York, T.
Davis, George E., 50 W. 37th St.,
New York, 8, 9, 0, 6.
Dean, J. W., 6 Pine St., Glens
Falls, 4.
Delevan, D. B., 40 E. 41st St., New
York, T.

Dench, Edw. B., 15 E. 53d St., New
York, T.
Dunning, Wm. M., 391 E. 149th
St., New York, 4.
Fairbairn, J. F., 131 Allen St., Buf-
falo, 8, 9, 4, 6.
Fell, George E., 209 Porter Ave.,
Buffalo, 6.
Forbes, Henry H., 40 E. 41st St.,
New York, 3.
Forsyth, E. A., 322 Franklin St.,
Buffalo, 9, 4, 6.
Fowler, Edmund P., 616 Madison
Ave., New York, 9, 4.
Freudenthal, W., 1003 Madison
Ave., New York, 8, 2.
Friesner, Isidore, 814 Lexington
Ave., New York, 4, 6.
Fuchsius, John H., 93 Centre Ave.,
New Rochelle, 2.
Gates, Aden C., 574 Broadway,
Kingston, T.
Glogau, Otto, 1320 Madison Ave.,
New York, 9, 0, 2.
Grove, Benjamin H., 334 Pearl St.,
Buffalo, T.
Grushlaw, Israel, 271 Central Park-
West, New York, 2.
Halsted, T. H., University Blk.,
Syracuse, T.
Hays, Harold M., 11 W. 81st St.,
New York, 4.
Heller, Isaac M., 450 E. Tremont
Ave., New York, 2, 6.
Herriman, Frank R., 167 Quincy
St., Brooklyn, 4.
Heatly, John A., 511 State St.,
Schenectady, 6.
Hinkel, Frank W., 581 Delaware
Ave., Buffalo, T.
Hitzel, Gustave A., 49 E. Parade
Ave., Buffalo, T.
Howell, H. P., 616 Madison Ave.,
New York, 4.
Hoyt, Herbert W., 174 East Ave.,
Rochester, 6.
Hubby, Lester M., 27 W. 68th St.,
New York, 4.
Hunt, W. J., 21 Notre Dame, Glens
Falls, T.
Hurd, Lee M., 15 E. 48th St., New
York, 2, 4.
Ingersoll, Edwin S., 347 Monroe
Ave., Rochester, 6.
Jacobs, Simon M., 1187 Boston Rd.,
New York City, T.
Jarecky, Herman, 138 W. 86th St.,
New York, 2.
Johnson, O. H., 2345 Broadway,
New York, 6.
Keens, Wm. G., 85 West St., Al-
bany, 4.
Kenefick, Jos. A., 78 E. 54th St.,
New York, 4.
Kepke, John, 488 Nostrand Ave.,
Brooklyn, 9, 2.
Kerrison, Philip D., 58 W. 56th St.,
New York, T.
King, Jas. J., 40 E. 41st St., New
York, 4, 6.
Kirkendall, John S., 315 N. Aurora
St., Ithaca, 5, 7, 9, 4.
Kopetzky, Samuel J., 616 Madison
Ave., New York, 4.
Law, Frederick M., 576, 5th Ave.,
New York, 2, 4.

Leshure, John, 423 Convent Ave., New York, 2.
 Lewis, G. Griffin, University Block, Syracuse, T.
 Loughran, Robert L., 46 W. 52d St., New York City, 6.
 Lutz, Stephen Henry, 284 Hancock St., Brooklyn, 6, 9, 2.
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INDEX

	PAGE
Auten, F. E.: discussion on tonsillectomy.....	301
Barnhill, J. F.: paper on the treatment of chronic suppurative otitis media	153
Discussion on same.....	167
Discussion on sinuses.....	130
Discussion on tonsillectomy.....	302
Beck, J. C.: paper on external frontal sinus operation.....	55
Discussion on same.....	131
Discussion on the mastoid operation.....	181
Bronchoscopic treatment, nonsurgical; paper by R. F. Ridpath.....	212
Discussion	240
Bronchoscopy and esophagoscopy in extraction of foreign bodies; paper by C. Jackson.....	227
Brown, C. M.: discussion on xanthosis.....	32
Butt, W. R.: discussion on bronchoscopy.....	245
Canfield, R. B.: discussion on the mastoid operation.....	180
Carter, W. W.: discussion on external nasal deformities.....	254
Discussion on tonsillectomy.....	301, 304
Cerebellar lesions and purulent labyrinthitis, differential diagnosis between; paper by I. Friesner.....	268
Discussion	282
Cerebellopontile angle, tumor of, importance of aural symptoms in early diagnosis of; paper by W. P. Eagleton.....	274
Discussion	282
Chamberlin, W. B.: discussion on bronchoscopy.....	240
Clift, M. W.: discussion on sinuses.....	131
Coates, G. M.: paper on clinical experience with vaccines.....	194
Discussion on same.....	211
Cohen, L.: paper on external nasal deformities.....	248
Discussion on same.....	256
Discussion on bronchoscopy.....	244
Discussion on sinuses.....	128
Connellan, J. J.: discussion on the Connellan-King diplococcus....	41
Connellan-King diplococcus throat infections; paper by J. J. King..	33
Discussion	41
Cott, C. C.: paper on xanthosis and other septal hemorrhages.....	25
Discussion on same.....	32
Discussion on cerebellar lesions.....	286
Cott, G. F.: paper on empyema of the ethmoid cells.....	74
Discussion on same.....	132
Discussion on bronchoscopy.....	243
Discussion on the Connellan-King diplococcus.....	43
Discussion on xanthosis.....	31
Davis, D. J.: paper on vaccine therapy.....	184
Discussion on same.....	211
Dixon, W. E.: discussion on bronchoscopy.....	243
Discussion on otitis media.....	161, 163
Discussion on tonsillectomy.....	300
Dwight, C. G.: discussion on sinuses.....	128
Eagleton, W. P.: paper on aural symptoms in early diagnosis of tumor of cerebellopontile angle.....	274
Discussion on same.....	287
Ear suppuration, chronic, prevention of; paper by G. W. Mackenzie	135
Discussion	160

	PAGE
Emerson, F. P.: discussion on otitis media.....	160
Empyema of ethmoid cells; paper by G. F. Cott.....	74
Discussion	127
Esophagoscopy and bronchoscopy in extraction of foreign bodies; paper by C. Jackson.....	227
Discussion	240
Ethmoid cells, empyema of; paper by G. F. Cott.....	74
Discussion	127
Ethmoid labyrinth, surgery of; paper by G. E. Shambaugh.....	79
Discussion	127
Ethmoid, oblique roentgenography of; paper by S. Iglauer.....	121
Discussion	127
Fisher, L.: discussion on cerebellar lesions.....	285
Foreign bodies, extraction of, mechanical problems of bronchoscopy and esophagoscopy	227
Discussion	240
Friesner, I.: paper on differential diagnosis between purulent laby- rinthitis and cerebellar lesions.....	268
Discussion on same.....	287
Frontal sinus, external operation; paper by J. C. Beck.....	55
Discussion	127
Frontal sinusitis, intranasal surgery for; paper L. M. Hurd.....	67
Discussion	127
Gibney, V. P.: discussion on the Connellan-King diplococcus.....	43
Good, R. H.: discussion on bronchoscopy.....	244
Harris, H. B.: discussion on otitis media.....	163
Hastings, H.: paper on purulent infections of nose, throat and ear. 17	
Hawley, C. W.: discussion on otitis media.....	165
Hemorrhage, nasal; paper by C. C. Cott.....	25
Discussion	30
Henderson, E. E.: discussion on tonsillectomy.....	303
Hitz, H. B.: discussion on xanthosis.....	31
Holinger, J.: discussion on cerebellar lesions.....	283
Discussion on otitis media.....	162, 167
Hubbard, T.: discussion on bronchoscopy.....	241
Hurd, L. M.: paper on intranasal surgery for frontal sinusitis.....	67
Iglauer, S.: paper on oblique roentgenography of ethmoid and sphenoid cells	121
Discussion on same.....	133
Discussion on bronchoscopy.....	241
Infections, purulent, of nose, throat and ear; paper by H. Hastings. 17	
Jackson, C.: paper on extraction of foreign bodies.....	227
Discussion on same.....	246, 247
Jones, E. L.: discussion on otitis media.....	162
Jones, I. H.: discussion on cerebellar lesions.....	282
Discussion on the Connellan-King diplococcus.....	43
Keiper, G. F.: discussion on bronchoscopy.....	244
Kenyon, E. L.: discussion on external nasal deformities.....	255
Kerrierson, P. D.: paper on the mastoid operation.....	168
Discussion on same.....	183
King, J. J.: paper on the Connellan-King diplococcus throat infec- tions	33
Discussion on same.....	43
Labyrinthitis, clinical types and treatment; paper by W. C. Phillips. 257	
Discussion	282
Labyrinthitis, purulent, and cerebellar lesions; paper by I. Friesner. 268	
Discussion	282
Laryngoscopy, suspension; paper by R. C. Lynch.....	223
Discussion	240
Layman, D. W.: discussion on vaccines.....	210
Lewis, E. R.: discussion on tonsillectomy.....	300

INDEX

323

	PAGE
Loeb, H. W.: paper on the sphenoid sinus.....	92
Discussion on tonsillectomy.....	302
Lynch, R. C.: paper suspension laryngoscopy.....	223
Mackenzie, G. W.: paper on prevention of chronic middle ear sup- puration	135
Discussion on same.....	165
Discussion on cerebellar lesions.....	284
McNaught, H. M.: discussion on sinuses.....	129
Makuen, G. H.: discussion on tonsillectomy.....	297
Marquis, G. P.: discussion on tonsillectomy.....	299
Mastoid operation of ten years ago and of today; paper by P. D. Kerrison	168
Discussion	180
Maxillary sinusitis, chronic, surgical treatment of; paper by W. E. Sauer	86
Discussion	127
Mayer, E.: discussion on the Connellan-King diplococcus.....	42
Discussion on xanthosis.....	30
Mosher, H. P.: discussion on bronchoscopy.....	242
Discussion on sinuses.....	127
Murphy, J. W.: discussion on bronchoscopy.....	244
Newhart, H.: discussion on cerebellar lesions.....	282
Nose, external deformities of; paper by L. Cohen.....	248
Discussion	254
Otitis media, chronic, suppurative, end-results of treatment; paper by J. F. Barnhill.....	153
Discussion	160
Otitis media, nonoperative treatment of; paper by N. H. Pierce....	146
Discussion	160
Phillips, W. C.: paper on clinical types of labyrinthitis.....	257
Discussion on the mastoid operation.....	182
Pierce, N. H.: paper on nonoperative treatment of otitis media....	146
Discussion on same.....	166
Pratt, J. A.: discussion on vaccines.....	210
Prince, A. E.: discussion on otitis media.....	162
Ridpath, R. F.: paper on nonsurgical bronchoscopic treatment.....	212
Discussion on same.....	245
Robertson, C. M.: discussion on otitis media.....	164
Roentgenography, oblique, of ethmoid and sphenoid cells; paper by S. Iglauer	121
Discussion	127
Sauer, W. E.: paper on surgical treatment of chronic maxillary sinusitis	86
Shambaugh, G. E.: paper on surgery of the ethmoid labyrinth.....	79
Discussion on same.....	132
Shurly, B. R.: paper on thyroid disease in relation to rhinology and laryngology	45
Skillern, R. H.: paper on the sphenoid sinus.....	99
Discussion on bronchoscopy.....	243
Sluder, G.: paper on method of tonsillectomy.....	288
Discussion on same.....	305
Sphenoid, oblique roentgenography of; paper by S. Iglauer.....	121
Discussion	127
Sphenoid sinus; paper by H. W. Loeb.....	92
Discussion	127
Sphenoid sinus, surgery of; paper by R. H. Skillern.....	99
Discussion	127
Thyroid disease in relation to rhinology and laryngology; paper by B. R. Shurly.....	45
Tomlin, W. S.: discussion on otitis media.....	164
Discussion on tonsillectomy.....	303

	PAGE
Tonsillectomy by means of the alveolar eminence of mandible and guillotine; paper by G. Sluder.....	288
Discussion	297
Tumor of cerebellopontile angle, importance of aural symptoms in early diagnosis of; paper by W. P. Eagleton.....	274
Discussion	282
Tydings, O.: discussion on otitis media.....	163
Discussion on tonsillectomy.....	304, 305
Vaccines, clinical experience with; paper by G. M. Coates.....	194
Discussion	210
Vaccine therapy; paper by D. J. Davis.....	184
Discussion	210
Walter, F.: discussion on sinuses.....	129
Welty, C. F.: discussion on the mastoid operation.....	180
Discussion on otitis media.....	161
Discussion on sinuses.....	130
Discussion on tonsillectomy.....	303
Discussion on xanthosis.....	31
Xanthosis and other septal hemorrhages; paper by C. C. Cott.....	25
Discussion	30

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